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REPORT

OF THE

TESTS OF METALS

AND OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN
ARSENAL, MASSACHUSETTS, DURING THE
FISCAL YEAR ENDED JUNE 30

1909

IN FIVE PARTS

VOL. 3

(PART V)

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

Eng 318.81.3

Harvard College Library
JUN 13 1911
From the
U. S. Government.

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PART V.

SECTION 1.

COLUMN TESTS.

LAP-WELDED STEEL TUBING.

COMPRESSION TESTS.

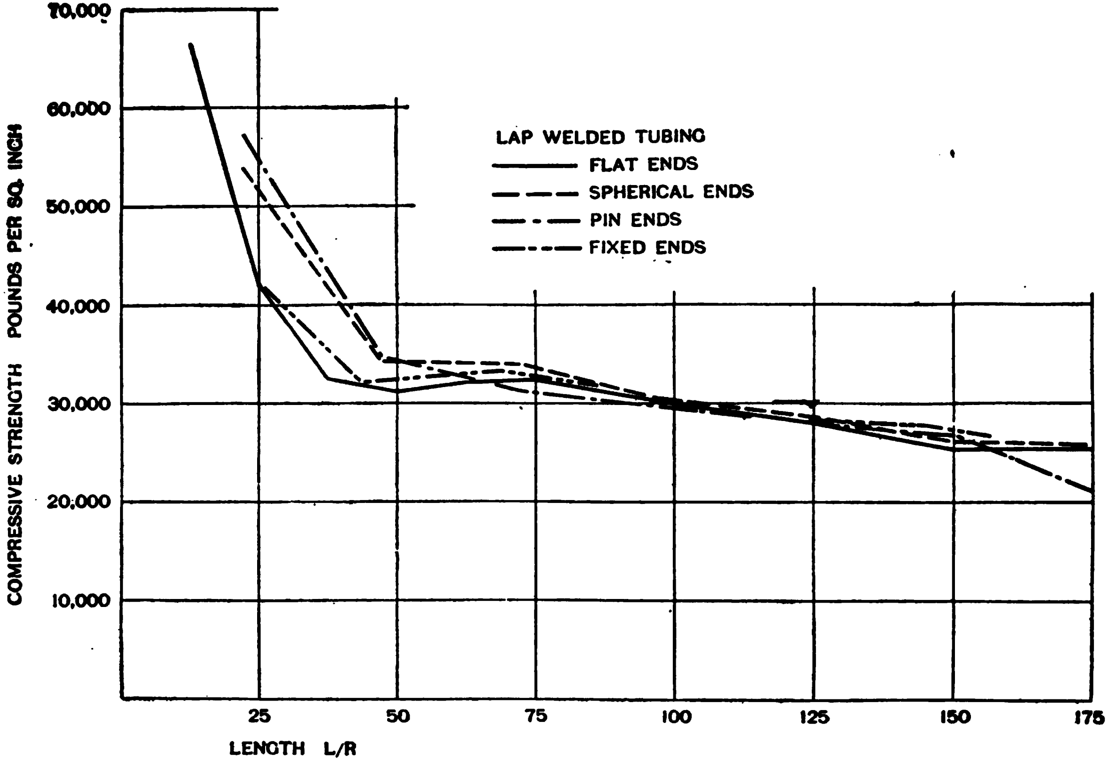
Dimensions of tubing.—Nominal diameter, 5″; nominal thickness, ″.36.
Tests continued from report of 1908.

Bessemer Steel Lap-welded Tubing.

Nominal weight, 18.22 pounds per foot.
Nominal sectional area, 5.25 square inches.
Radius of gyration, 1″.645.

SCHEDULE OF LENGTHS.

1 foot 8 9/16 inches.....	12.5 l/r
3 feet 5 1/8 inches......	25 l/r
5 feet 1 11/16 inches.....	37.5 l/r
6 feet 10 1/4 inches.....	50 l/r
8 feet 6 13/16 inches.....	62.5 l/r
10 feet 3 3/8 inches......	75 l/r
13 feet 8 1/2 inches......	100 l/r
17 feet 1 5/8 inches......	125 l/r
20 feet 6 3/4 inches......	150 l/r
24 feet................	175 l/r



LAP WELDED STEEL TUBING.

CURVES OF COMPRESSIVE STRENGTH, WITH DIFFERENT END CONDITIONS.

LAP-WELDED STEEL TUBING.

SPHERICAL END TESTS.

Radius of curvature of spherical ends, 2''.75.
Radius of curvature of seats, 3''.00.

No. 1929.

Lap-welded tubing, 5'' nominal diameter.
Spherical ends.
Length: Tubing, 2 feet 5½ inches; over spherical ends, 3 feet ½ inch.
Weight, 43½ pounds.
Sectional area, 5.20 square inches.
Thickness of tubing, ''.32 to ''.38.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
175,000	33,650	....	....	....	....	Scale starts off.
193,000	37,110	....	....	....	....	General scaling.
298,000	57,200	....	....	....	....	Ultimate strength.

Failed by triple flexure. Local bulging near ends.

No. 1930.

Lap-welded tubing, 5'' nominal diameter.
Spherical ends.
Length: Tubing, 2 feet 5½ inches; over spherical ends, 3 feet ½ inch.
Weight, 43 pounds.
Sectional area, 5.15 square inches.
Thickness of tubing, ''.32 to ''.39.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
185,000	35,920	....	....	....	....	Scale starts off.
296,000	57,480	....	....	....	....	Ultimate strength.

Failed by triple flexure. Local bulging at ends.

No. 1931.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 2 feet 5½ inches; over spherical ends, 3 feet ½ inch.
Weight, 43½ pounds.
Sectional area, 5.21 square inches.
Thickness of tubing, ″.34 to ″.38.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
186,000	35,700	....	....	....	....	Scale starts off.
306,800	58,890	....	....	....	....	Ultimate strength.

Failed by triple flexure. Local bulging at ends.

No. 1926.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 5 feet 10½ inches; over spherical ends, 6 feet 5½ inches.
Weight, 104½ pounds.
Sectional area, 5.23 square inches.
Thickness of tubing, ″.34 to ″.39.
Initial deflection: Horizontal, 0″; vertical, ″.06.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0062	....	0.	0.	
52,300	10,000	.0143	.0001	0.	0.	
....	1,000	....	....	0.	0.	
78,450	15,000	.0223	....	.02	0.	
104,600	20,000	.0307	.0004	.02	0.	
....	1,000	....	....	0.	0.	
130,750	25,000	.0390	.0009	.02	.01	
....	1,000	....	....	0.	0.	
135,980	26,000	.0409	....	.03	.01	
141,710	27,000	.0426	....	.03	.01	
146,440	28,000	.0444	....	.03	.01	
151,670	29,000	.0466	....	.03	.01	
156,900	30,000	.0489	.0019	.03	.01	
....	1,000	....	....	0.	0.	
162,130	31,000	.0512	....	.03	.01	
167,360	32,000	.0544	....	.03	.01	
172,590	33,000	.0607	....	.04	.02	
177,820	34,000	.0696	....	.04	.04	
183,050	35,000	....	....	.06	.10	Ultimate strength.
165,000	....	....	....	.18	.49	

Deflected obliquely upward at middle of length.

No. 1927.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 5 feet 10½ inches; over spherical ends, 6 feet 5½ inches.
Weight, 104½ pounds.
Sectional area, 5.23 square inches.
Thickness of tubing, ″.34 to ″.40.
Initial deflection: Horizontal, ″.05; vertical, 0″.
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0060	....	.01	0.	
52,300	10,000	.0136	0.	.02	0.	
....	1,000	....	....	0.	0.	
78,450	15,000	.0216	....	.02	.01	
104,600	20,000	.0298	.0004	.03	.02	
....	1,000	....	....	0.	0.	
130,750	25,000	.0380	....	.03	.02	
156,900	30,000	.0478	.0024	.03	.02	
....	1,000	....	....	0.	0.	
162,130	31,000	.0505	....	.03	.02	
167,360	32,000	.0537	....	.03	.02	
172,590	33,000	.0577	....	.03	.03	
176,000	33,650	....	....	....	....	Ultimate strength.

Deflected obliquely upward at middle of length.

No. 1928.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 5 feet 10½ inches; over spherical ends, 6 feet 7½ inches.
Weight, 104½ pounds.
Sectional area, 5.23 square inches.
Thickness of tubing, ″.34 to ″.40.
Initial deflection: Horizontal, ″.03; vertical, 0″.
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0068	....	0.	0.	
52,300	10,000	.0154	0.	.01	0.	
....	1,000	....	....	0.	0.	
78,450	15,000	.0239	....	.02	0.	
104,600	20,000	.0322	.0004	.02	.01	
....	1,000	....	....	0.	0.	
130,750	25,000	.0403	....	.02	.01	
156,900	30,000	.0510	.0033	.03	0.	
....	1,000	....	....	.02	0.	
162,130	31,000	.0537	....	.03	−.01	
167,360	32,000	.0582	....	.07	−.03	
172,590	33,000	.0618	....	.08	−.06	
176,800	33,800	....	....	.13	−.15	Ultimate strength.

Deflected obliquely upward at middle of length.

No. 1923.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 9 feet 3¾ inches; over spherical ends, 9 feet 10¾ inches.
Weight, 163 pounds.
Sectional area, 5.15 square inches.
Thickness of tubing, ″.33 to ″.38.
Initial deflection: Horizontal, ″.08; vertical, ″.05.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,150	1,000	0.	0.	0.	0.	Initial load.
25,750	5,000	.0065	....	.02	0.	
51,500	10,000	.0147	.0002	.03	0.	
....	1,000	....	....	0.	0.	
77,250	15,000	.0223	....	.03	0.	
103,000	20,000	.0301	.0003	.03	.01	
....	1,000	....	....	0.	0.	
128,750	25,000	.0380	.0003	.04	.02	
....	1,000	....	....	0.	0.	
133,900	26,000	.0397	....	.04	.02	
139,050	27,000	.0414	....	.04	.02	
144,200	28,000	.0431	....	.04	.02	
149,350	29,000	.0448	....	.04	.02	
154,500	30,000	.0465	.0006	.04	.02	
....	1,000	....	....	.01	0.	
159,650	31,000	.0483	....	.04	.02	
164,800	32,000	.0504	....	.04	.02	
169,950	33,000	.0530	....	.05	.03	
175,100	34,000	.0558	....	.05	.04	
178,200	34,600	....	....	.02	.18	Ultimate strength.
	Deflections gradually increased without sudden loss in resistance.					
123,000	....	....	....	.18	1.71	

Deflected upward at middle of length.

No. 1924.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 9 feet 3¾ inches; over spherical ends, 9 feet 10¾ inches.
Weight, 165½ pounds.
Sectional area, 5.22 square inches.
Thickness of tubing, ″.32 to ″.39.
Initial deflection: Horizontal, ″.08; vertical, ″.02.
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,220	1,000	0.	0.	0.	0.	Initial load.
26,100	5,000	.0080	....	.02	0.	
52,200	10,000	.0173	.0003	.03	.01	
....	1,000	....	....	0.	0.	
78,300	15,000	.0254	....	.04	.01	
104,400	20,000	.0342	.0009	.04	.02	
....	1,000	....	....	0.	0.	
130,500	25,000	.0430	.0019	.05	.02	
....	1,000	....	....	.01	0.	
....	....	....	.0023	....	....	Rested under initial load 16 hours.
135,720	26,000	.0453	....	.04	.02	
140,940	27,000	.0468	....	.05	.02	
146,160	28,000	.0486	....	.05	.02	
151,380	29,000	.0509	....	.06	.02	
156,600	30,000	.0535	.0048	.06	.02	
....	1,000	....	....	.01	0.	
161,820	31,000	.0564	....	.07	.02	
167,040	32,000	.0605	....	.07	.02	
172,260	35,000	.0740	....	.16 .21	.02 .01	Ultimate strength.
165,000	....	....	....	.39	.02	Deflections as resistance fell.
160,000	....	....	....	.67	.06	
145,000	....	....	....	1.19	.14	
100,000	....	....	....	2.64	.35	
55,000	....	....	....	5.00	....	

[illegible] nominal diameter.

[illegible] vertical [illegible]

[illegible] horizontal [illegible] vertical [illegible]

[illegible] middle

[illegible]	[illegible]	[illegible]	Deflections at middle		Remarks
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Initial loads.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Ultimate strength.

Deflection [illegible] at the middle

No. 1920.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 12 feet 8⅞ inches; over spherical ends, 13 feet 3⅞ inches.
Weight, 225 pounds.
Sectional area, 5.19 square inches.
Thickness of tubing, ″.34 to ″.37.
Initial deflection: Horizontal, kinks ″.08; vertical, ″.01.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,190	1,000	0.	0.	0.	0.	Initial load.
25,950	5,000	.0115	....	.03	.03	
51,900	10,000	.0269	0.	.04	.04	
....	1,000	....	....	0.	.01	
77,850	15,000	.0433	....	.05	.07	
103,800	20,000	.0588	.0005	.07	.08	
....	1,000	....	....	0.	.01	
108,990	21,000	.0621	....	.08	.08	
114,180	22,000	.0653	....	.07	.08	
119,370	23,000	.0688	....	.07	.08	
124,560	24,000	.0720	....	.08	.08	
129,750	25,000	.0753	.0022	.08	.09	
....	1,000	....	....	0.	.02	
134,940	26,000	.0792	....	.08	.09	
140,130	27,000	.0823	....	.08	.09	
145,320	28,000	.0857	....	.09	.09	
150,510	29,000	.0896	....	.10	.10	
155,700	30,000	.0941	.0050	.11	.10	
....	1,000	....	....	.03	.03	
160,890	31,000	.1002	.0062	.11	.11	Scale starts off, 34 inches from end of specimen.
....	1,000	....	....	.06	.03	
166,080	32,000	....	....	.17	.13	Ultimate strength.
140,000	....	....	....	.80	....	Load when sudden springing occurred.
96,000	....	....	....	1.68	.82	Deflections and load sustained after sudden springing.

No. 1921.

Lap-welded tubing, 5″ nominal diameter.

Spherical ends.

Length: Tubing, 12 feet 9 inches; over spherical ends, 13 feet 4 inches.

Weight, 227½ pounds.

Sectional area, 5.25 square inches.

Thickness of tubing, ″.33 to ″.37.

Initial deflection: Horizontal, wavy, ″.14; vertical, 0″.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Com-pression.	Set.	Hori-zontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,250	1,000	0.	0.	0.	0.	Initial load.
26,250	5,000	.0150	....	.01	.02	
52,500	10,000	.0325	.0007	.03	.02	
....	1,000	....	....	0.	0.	
78,750	15,000	.0500	....	.04	.03	
105,000	20,000	.0676	.0015	.05	.04	
....	1,000	....	....	0.	0.	
131,250	25,000	.0867	.0048	.06	.04	
....	1,000	....	....	.01	.01	
136,500	26,000	.0916	....	.07	.06	
141,750	27,000	.0968	....	.08	.06	
147,000	28,000	.1024	....	.10	.06	
152,250	29,000	.1098	....	.11	.09	
157,500	30,000	.1220	.0037	.19	.12	
....	1,000	....	....	.12	.10	
158,400	30,170	....	....	.44	.26	Ultimate strength.
140,000	....	....	....	.78	....	Load and deflection when sudden deflection occurred.
98,000	....	....	....	1.40	1.18	Deflections and load after sudden springing.

No. 1922.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 12 feet 9 inches; over spherical ends, 13 feet 4 inches.
Weight, 223 pounds.
Sectional area, 5.14 square inches.
Thickness of walls, ″.30 to ″.38.
Initial deflection: Horizontal, ″.09; vertical, ″.03.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,140	1,000	0.	0.	0.	0.	Initial load.
25,700	5,000	.0104	....	.02	.04	
51,400	10,000	.0258	0.	.02	.06	
....	1,000	....	....	0.	0.	
77,100	15,000	.0425	....	.03	.07	
102,800	20,000	.0586	.0010	.04	.07	
....	1,000	....	....	0.	.01	
128,500	25,000	.0767	.0022	.05	.09	
....	1,000	....	....	.01	.01	
133,640	26,000	.0807	....	.05	.09	
138,780	27,000	.0842	....	.05	.09	
143,920	28,000	.0887	....	.06	.09	
149,060	29,000	.0945	....	.07	.11	
152,700	29,710	....	....	.17	.30	Ultimate strength.
138,000	....	....	....	.32	....	Load and deflection when sudden deflection occurred.
96,000	....	....	....	.61	1.42	Load and deflections after sudden springing.

Maximum deflection occurred 1 foot 10 inches from middle of length of specimen.

No. 1917.

Lap welded tubing, 5″ nominal diameter.

Spherical ends.

Length: Tubing, 16 feet 6¼ inches; over spherical ends, 17 feet 1¾ inches.

Weight, 292½ pounds.

Sectional area, 5.19 square inches.

Thickness of tubing, ″.31 to ″.39.

Initial deflection: Horizontal, ″.15 wavy; vertical, ″.08.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,190	1,000	0.	0.	0.	0.	Initial load.
25,950	5,000	.0140	....	.07	0.	
51,900	10,000	.0297	0.	.11	.01	
....	1,000	....	....	.01	0.	
77,850	15,000	.0460	....	.14	.03	
103,800	20,000	.0622	.0001	.19	.05	
....	1,000	....	....	.01	.01	
108,990	21,000	.0652	....	.20	.05	
114,180	22,000	.0685	....	.21	.05	
119,370	23,000	.0718	....	.21	.05	
124,560	24,000	.0752	....	.22	.05	
129,750	25,000	.0783	.0010	.25	.06	
....	1,000	....	....	.04	.03	
134,940	26,000	.0817	....	.27	.07	
140,130	27,000	.0852	.0017	.31	.10	
....	1,000	....	....	.06	.03	
145,320	28,000	....	....	.37	.16	
150,000	28,900	....	....	.53	.23	Ultimate strength.
76,000	....	....	....	2.61	.98	Load and deflections after column had passed maximum load and sprung laterally.

No. 1918.

Lap welded tubing, 5″ nominal diameter.

Spherical ends.

Length: Tubing, 16 feet $6\frac{11}{16}$ inches; over spherical ends, 17 feet $1\frac{11}{16}$ inches.

Weight, 294 pounds.

Sectional area, 5.22 square inches.

Thickness of tubing, ″.34 to ″.37.

Initial deflection: Horizontal, ″0; vertical, ″.05.

Gauged length, 100.″

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,220	1,000	0.	0.	0.	0.	Initial load.
26,100	5,000	.0128	....	.04	.01	
52,200	10,000	.0290	.0002	.09	.02	
....	1,000	....	....	0.	0.	
78,300	15,000	.0450	....	.10	.03	
104,400	20,000	.0608	.0004	.13	.04	
....	1,000	....	....	0.	0.	
109,620	21,000	.0638	....	.14	.05	
114,840	22,000	.0678	....	.14	.05	
120,060	23,000	.0710	....	.15	.05	
125,280	24,000	.0746	....	.16	.05	
130,500	25,000	.0787	.0027	.17	.05	
....	1,000	....	....	.02	0.	
135,720	26,000	.0832	....	.21	.05	
140,940	27,000	....	....	.41	.06	Ultimate strength.
120,000	....	....	....	....	....	Resistance gradually fell to this load, then suddenly sprung.
78,000	....	....	....	2.39	.15	Load and deflections after lateral springing.

No. 1919.

Lap welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 16 feet 6½ inches; over spherical ends, 17 feet 1½ inches.
Weight, 283½ pounds.
Sectional area, 5.04 inches.
Thickness of tubing, ″.32 to ″.37.
Initial deflection: Horizontal, ″.14; vertical, ″.04.
Gauged length, 100.″
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inches.*	*Inches.*	
5,040	1,000	0.	0.	0.	0.	Initial load.
25,200	5,000	.0124	....	.02	.02	
50,400	10,000	.0275	0.	.06	.04	
....	1,000	....	....	0.	.01	
75,600	15,000	.0436	....	.06	.05	
100,800	20,000	.0591	.0003	.06	.06	
....	1,000	....	....	0.	.01	
105,840	21,000	.0623	....	.06	.07	
110,880	22,000	.0658	....	.06	.08	
115,920	23,000	.0689	....	.07	.07	
120,960	24,000	.0719	....	.07	.08	
126,000	25,000	.0750	.0007	.07	.08	
....	1,000	....	....	.01	.01	
131,040	26,000	.0786	....	.07	.09	
136,080	27,000	.0823	....	.08	.10	
141,120	28,000	.0864	.0027	.08	.11	
....	1,000	....	....	.01	.02	
146,160	29,000	....	....	.06	.13	
151,200	30,000	....	....	.06	.16	Ultimate strength.
66,000	....	....	....	−2.48	2.79	Load and deflections after lateral springing.

No. 1914.

Lap welded tubing, 5″ nominal diameter.

Spherical ends.

Length: Tubing, 20 feet 0¼ inch; over spherical ends, 20 feet 7¼ inches.

Weight, 349 pounds.

Sectional area, 5.13 square inches.

Thickness of tubing, ″.34 to ″.37.

Initial deflection: Horizontal, wavy, ″.06; vertical, ″.10.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,130	1,000	0.	0.	0.	0.	Initial load.
25,650	5,000	.0147	....	.04	.05	
51,300	10,000	.0310	.0035	.06	.10	
....	1,000	....	....	.02	.03	
76,950	15,000	.0484	....	.08	.14	
102,600	20,000	.0650	.0052	.11	.20	
....	1,000	....	....	.03	.04	
107,730	21,000	.0674	....	.12	.22	
112,860	22,000	.0703	....	.13	.25	
117,990	23,000	.0732	.0052	.14	.32	
122,900	23,960	....	....	....	....	Ultimate strength.

Failed by lateral deflection in the direction of the initial upward deflection.

Sprung suddenly after reaching the maximum load, increasing the deflections to horizontal 1.01 inches, vertical 3.57 inches. In this bent shape the sustaining power of the tubing was 45,200 pounds.

No. 1915.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 19 feet 11¾ inches; over spherical ends, 20 feet 6¾ inches.
Weight, 345½ pounds.
Sectional area, 5.09 square inches.
Thickness of tubing, ″.33 to ″.37.
Initial deflection: Horizontal, kinks ″.06 to ″.14; vertical, ″.02.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,090	1,000	0.	0.	0.	0.	Initial load.
25,450	5,000	.0133	....	.05	.02	
50,900	10,000	.0297	0.	.10	.04	
....	1,000	....	....	0.	.01	
76,350	15,000	.0465	....	.12	.04	
101,800	20,000	.0627	.0002	.14	.04	
....	1,000	....	....	0.	.01	
106,890	21,000	.0663	....	.14	.04	
111,980	22,000	.0697	....	.15	.04	
117,070	23,000	.0733	....	.16	.04	
122,160	24,000	.0767	....	.17	.04	
127,250	25,000	.0804	.0007	.19	.04	
....	1,000	....	....	.02	.04	
132,340	26,000	.0830	....	.20	.06	
136,200	26,760	....	....	....	....	Ultimate strength.
						Load gradually fell while deflections increased.
122,000	....	....	....	.37	.32	Load and deflections at which sudden lateral springing occurred.
45,200	....	....	....	2.77	2.65	Load and deflections after sudden springing.
5,090	....	....	....	2.62	1.54	

No. 1916.

Lap welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 20 feet ¼ inch; over spherical ends, 20 feet 7¼ inches.
Weight, 354 pounds.
Sectional area, 5.20 square inches.
Thickness of tubing, ″.33 to ″.40.
Initial deflection: Horizontal, ″.11; vertical, ″.10 kinks.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,200	1,000	0.	0.	0.	0.	Initial load.
26,000	5,000	.0151	....	.01	0.	
52,000	10,000	.0317	.0013	.01	0.	
....	1,000	....	....	0.	0.	
78,000	15,000	.0491	....	.02	.03	
104,000	20,000	.0673	.0017	.03	.06	
....	1,000	....	....	.01	.01	
109,200	21,000	.0708	....	.03	.07	
114,400	22,000	.0752	....	.03	.09	
119,600	23,000	.0790	....	.03	.09	
124,800	24,000	.0829	....	.02	.10	
130,000	25,000	.0869	.0034	.01	.11	
....	1,000	....	....	.01	.03	
135,200	26,000	.0918	....	0.	.15	
140,400	27,000	.0975	.0046	−.01	.18	
....	1,000	....	....	0.	.04	
143,600	27,610	....	....	−.12	.40	Ultimate strength.
After passing the maximum load and while the resistance was falling, the test was discontinued temporarily. A counterweight at the middle of the length of the specimen of 500 pounds was applied, acting in a direction approximately opposite to the horizontal and vertical deflections developed at the time of maximum load. The test was then resumed, whereupon the specimen displayed increased ultimate resistance, now reaching 28,730 pounds per square inch.						
149,400	28,730	....	....	....	....	

Sudden springing succeeded the passing of this second maximum, with immediate loss in sustaining power, the same as displayed by other specimens of this series.

No. 1911.

Lap-welded tubing, 5″ nominal diameter.

Spherical ends.

Length: Tubing, 23 feet, 5½ inches; over spherical ends, 24 feet ½ inch.

Weight, 408½ pounds.

Sectional area, 5.13 square inches.

Thickness of tubing, ″.32 to ″.37.

Initial deflection: Horizontal, ″.13 wavy; vertical, ″.06.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,130	1,000	.0	0.	0.	0.	Initial load.
25,650	5,000	.0134	....	.01	0.	
51,300	10,000	.0308	0.	.02	.01	
....	1,000	....	....	0.	0.	
76,950	15,000	.0438	....	.03	.02	
102,600	20,000	.0606	−.0010	.07	.02	
....	1,000	....	....	0.	0.	
107,730	21,000	.0650	....	.08	.02	
112,860	22,000	.0683	....	.10	.01	
117,990	23,000	.0720	....	.12	0.	
123,120	24,000	.0756	....	.17	0.	
128,250	25,000	.0794	−.0006	.26	0.	
....	1,000	....	....	.01	0.	
133,380	26,000	....	....	....	....	Ultimate strength.
Tubing sprung suddenly in a sidewise direction. increasing the horizontal deflection to 4.21 inches and causing a downward movement of .56 inch. In this bent shape the sustaining power of the tubing was 38,700 pounds. Load reduced to initial load and deflections measured.						
5,130	1,000	....	....	1.13	.11	

Load again increased, the maximum load now sustained being 46,000 pounds.

No. 1912.

Lap-welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 23 feet 5¼ inches; over spherical ends, 24 feet ¼ inch.
Weight, 406 pounds.
Sectional area, 5.10 square inches.
Thickness of tubing, ″.35 to ″.38.
Initial deflection: Horizontal, ″.09; vertical, ″.13.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,100	1,000	0.	0.	0.	0.	Initial load.
25,500	5,000	.0136	....	.03	.01	
51,000	10,000	.0307	.0007	.04	.03	
....	1,000	....	....	0.	0.	
76,500	15,000	.0484	.0027	.05	.06	
....	1,000	....	....	0.	0.	
102,000	20,000	.0661	.0059	.10	.13	
....	1,000	....	....	.01	.01	
107,100	21,000	.0705	....	.12	.15	
112,200	22,000	.0728	....	.15	.18	
117,300	23,000	.0750	....	.16	.21	
122,400	24,000	.0762	.0075	.20	.29	
....	1,000	....	....	.01	.04	
127,100	24,920	....	....	....	....	Ultimate strength.

Tubing gradually increased in deflection for a time, then suddenly sprung upward and sidewise, the deflections becoming horizontal 1.15 inches, vertical 4.12 inches. In this bent state the tubing had a sustaining power of 38,400 pounds compression.

No. 1913.

Lap welded tubing, 5″ nominal diameter.
Spherical ends.
Length: Tubing, 23 feet 5¼ inches; over spherical ends, 24 feet 0¼ inch.
Weight, 416½ pounds.
Sectional area, 5.23 square inches.
Thickness of tubing, ″.33 to ″.36.
Initial deflection: Horizontal, ″.12; vertical, ″.04.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0134	....	.04	0.	
52,300	10,000	.0306	.0006	.06	.02	
....	1,000	....	....	0.	0.	
78,450	15,000	.0473	.0014	.08	.03	
....	1,000	....	....	0.	0.	
104,600	20,000	.0650	.0016	.13	.07	
....	1,000	....	....	0.	.02	
109,830	21,000	.0684	....	.14	.08	
115,060	22,000	.0720	....	.17	.09	
120,290	23,000	.0757	....	.18	.10	
125,520	24,000	.0794	.0020	.22	.12	
....	1,000	....	....	.01	.03	
130,750	25,000	....	....	.27	.14	
139,300	26,630	....	....	....	....	Ultimate strength.

Tubing gradually increased in deflection for a time, then suddenly sprung downward and sidewise, deflections becoming horizontal 4.05 inches, vertical .22 inch. At this time the sustaining power of the tube was 44,000 pounds.

PIN END TESTS.

Diameter of pins, 3″.00.
Diameter of seats, 3″$\frac{1}{64}$.
Tested with pins in a vertical position.

No. 1950.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 2 feet 5½ inches; column, C to C of pins 3 feet ½ inch.
Weight, 44 pounds.
Sectional area, 5.26 square inches.
Thickness of tubing, ″.32 to ″.39.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
172,000	32,700	....	....	....	....	Scale starts off.
306,000	58,170	....	....	....	....	Ultimate strength.

Failed by deflecting obliquely sidewise and downward, the principal direction being perpendicular to the axes of the pins.
Walls bulged near ends of tubing.

No. 1951.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 2 feet 5½ inches; column, C to C of pins 3 feet ½ inch.
Weight, 43½ pounds.
Sectional area, 5.21 square inches.
Thickness of tubing, ″.33 to ″.38.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
154,000	29,560	....	....	....	....	Scale starts off, vicinity of ends of tubing.
284,000	54,510	....	....	....	....	Ultimate strength.

Failed by deflection, perpendicular to the axis of the pins.

No. 1952.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length of tubing, 2 feet 5½ inches.
Length of column, C to C of pins 3 feet ½ inch.
Weight, 43½ pounds.
Sectional area, 5.21 square inches.
Thickness of tubing, ″.33 to ″.37.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
184,000	35,320	....	....	....	....	Scale starts off tubing.
310,800	59,650	....	....	....	....	Ultimate strength.

Failed by triple flexure. Deflected upward at middle of length in direction parallel to the axes of the pins.

Walls bulged near ends of tubing.

No. 1947.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 5 feet 10½ inches; column, C to C of pins 6 feet 5½ inches.
Weight, 103½ pounds.
Sectional area, 5.18 square inches.
Thickness of tubing, ″.31 to ″.38.
Initial deflection: Horizontal, 0″; vertical, 0.″
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,180	1,000	0.	0.	0.	0.	Initial load.
25,900	5,000	.0091	....	0.	.01	
51,800	10,000	.0197	.0001	.01	.02	
....	1,000	....	....	0.	0.	
77,700	15,000	.0279	....	.01	.02	
103,600	20,000	.0371	.0015	.02	.02	
....	1,000	....	....	0.	0.	
129,500	25,000	.0462	.0029	.01	.02	
....	1,000	....	....	0.	0.	
134,680	26,000	.0470	....	.02	.02	
139,860	27,000	.0482	....	.02	.02	
145,040	28,000	.0493	....	.02	.02	
150,220	29,000	.0509	....	.02	.01	
155,400	30,000	.0531	.0056	.03	.01	
....	1,000	....	....	0.	0.	
160,580	31,000	.0561	....	.03	.01	
165,760	32,000	.0617	....	.03	.01	
170,940	33,000	.0720	.0210	.04	.01	
....	1,000	....	....	.02	0.	
173,400	33,470	....	....	.06	.03	Ultimate strength.
136,000	....	....	....	.63	.09	Deflections under reduced load after passing maximum stress.

No. 1948.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 5 feet 10½ inches; column, C to C of pins, 6 feet 5½ inches.
Weight, 102½ pounds.
Sectional area, 5.13 square inches.
Thickness of tubing, ″.31 to ″.40.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,130	1,000	0.	0.	0.	0.	Initial load.
26,650	5,000	.0089	....	....	....	
51,300	10,000	.0181	.0004	.01	....	
....	1,000	....	....	0.	0.	
26,950	15,000	.0256	....	.01	....	
102,600	20,000	.0343	.0007	.01	....	
....	1,000	....	....	0.	0.	
128,250	25,000	.0432	.0009	.01	.01	
....	1,000	....	....	0.	0.	
133,380	26,000	.0447	....	.01	.01	
138,510	27,000	.0460	....	.01	.01	
143,640	28,000	.0475	....	.01	.01	
148,770	29,000	.0491	....	.01	.01	
153,900	30,000	.0509	.0016	.01	.01	
....	1,000	....	....	0.	0.	
159,030	31,000	.0527	....	.01	.01	
164,160	32,000	.0548	....	.01	.02	
169,290	33,000	.0571	....	.01	.02	
174,420	34,000	.0612	....	.01	.03	
179,550	35,000	.0760	.0217	.01	.05	Ultimate strength.
....	1,000	....	....	.01	.04	
179,550	35,000	....	....	.10	.22	
130,000	....	....	....	.85	.59	Deflections under reduced load, after passing maximum stress.

No. 1949.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 5 feet 10½ inches; column, C to C of pins, 6 feet 5½ inches.
Weight, 104 pounds.
Sectional area, 5.21 square inches.
Thickness of tubing, ″.32 to ″.39.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,210	1,000	0.	0.	0.	0.	Initial load.
26,050	5,000	.0105	....	....	.01	
52,100	10,000	.0200	.0005	....	.02	
....	1,000	....	....	0.	0.	
78,150	15,000	.0278	....	....	.02	
104,200	20,000	.0369	.0008	.01	.02	
....	1,000	....	....	0.	0.	
130,250	25,000	.0450	.0013	.01	.02	
....	1,000	....	....	0.	0.	
135,460	26,000	.0460	....	.01	.02	
140,670	27,000	.0478	....	.01	.02	
145,880	28,000	.0493	....	.01	.02	
151,090	29,000	.0510	....	.01	.02	
156,300	30,000	.0528	.0024	.01	.02	
....	1,000	....	....	0.	0.	
161,510	31,000	.0544	....	.01	.02	
166,720	32,000	.0564	....	.01	.02	
171,930	33,000	.0581	....	.01	.02	
177,140	34,000	.0642	....	.01	.02	
182,350	35,000	.0720	.0150	.02	.04	
....	1,000	....	....	0.	.02	
....	35,000	....	....	.02	.04	Load reapplied.
185,400	35,590	....	....	.05	.03	Ultimate strength.

Assumed a curved shape with reversed bend along middle of length.

No. 1944.

Lap welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubimg, 9 feet 3¾ inches; column C to C pins, 9 feet 10¾ inches.
Weight, 169 pounds.
Sectional area, 5.34 square inches.
Thickness of tubing, ″.32 to ″.38.
Initial deflection: Horizontal, ″.12; vertical, ″.05.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,340	1,000	0.	0.	0.	0.	Initial load.
26,700	5,000	.0056	....	.01	.01	
53,400	10,000	.0143	.0005	.02	.02	
....	1,000	....	....	0.	0.	
80,100	15,000	.0225	....	.02	.02	
106,800	20,000	.0306	.0005	.02	.02	
....	1,000	....	....	0.	0.	
133,500	25,000	.0390	.0002	.04	.03	
....	1,000	....	....	0.	.01	
138,840	26,000	.0405	....	.05	.03	
144,180	27,000	.0422	....	.05	.04	
149,520	28,000	.0438	....	.06	.04	
154,860	29,000	.0454	....	.07	.05	Scale starts off.
160,200	30,000	....	....	.15	.09	Ultimate strength.

Column failed by deflecting horizontally, perpendicular to the axes of the pins. Sudden springing did not occur.

No. 1945.

Lap-welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 9 feet 3¾ inches; column C to C of pins, 9 feet 10¾ inches.
Weight, 166 pounds.
Sectional area, 5.24 square inches.
Thickness of tubing, ″.33 to ″.38.
Initial deflection: Horizontal, 0″; vertical, ″.15.
Gauged length, 50″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,240	1,000	0.	0.	0.	0.	Initial load.
26,200	5,000	.0054	....	....	.01	
52,400	10,000	.0136	.0003	....	.02	
....	1,000	....	....	0.	0.	
78,600	15,000	.0212	....	....	.02	
104,800	20,000	.0286	.0002	....	.02	
....	1,000	....	....	0.	0.	
131,000	25,000	.0371	.0002	....	.03	
....	1,000	....	....	0.	0.	
136,240	26,000	.0392	....	0.	.03	
141,480	27,000	.0410	....	.01	.03	
146,720	28,000	.0428	....	.01	.03	
151,960	29,000	.0445	....	.01	.03	
157,200	30,000	.0466	.0012	.01	.04	
....	1,000	....	....	0.	.01	
162,440	31,000	....	....	.01	.05	
167,680	32,000	....	....	0.	.07	Ultimate strength.
		Deflections observed as resistance of column fell, as follows:				
150,000	....	....	....	.05	.86	
118,000	....	....	....	.85	2.06	

Principal direction of deflection, parallel to axes of pins.

No. 1946.

Lap-welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 9 feet 3¾ inches; column, C to C of pins, 9 feet 10¾ inches.
Weight, 166½ pounds.
Sectional area, 5.26 square inches.
Thickness of tubing, ″.34 to ″.38.
Initial deflection: Horizontal, ″.08; vertical, 0″.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,260	1,000	0.	0.	0.	0.	Initial load.
26,300	5,000	.0078	....	0.	.01	
52,600	10,000	.0168	.0007	.01	.01	
....	1,000	....	....	0.	0.	
78,900	15,000	.0243	....	.03	.01	
105,200	20,000	.0327	.0010	.03	.01	
....	1,000	....	....	0.	0.	
131,500	25,000	.0420	.0017	.04	.01	
....	1,000	....	....	0.	0.	
136,760	26,000	.0439	....	.04	.01	
142,020	27,000	.0455	....	.05	.01	
147,280	28,000	.0471	....	.05	.01	
152,540	29,000	.0490	....	.06	.01	
157,800	30,000	.0510	.0038	.06	.01	
....	1,000	....	....	.03	.01	
163,060	31,000	.0551	....	.09	.01	
167,300	31,810	....	....	.17	.02	Ultimate strength.
120,000	....	....	....	.90	.03	Load and deflections when test was discontinued.

No. 1941.

Lap-welded tubing, 5″ nominal diameter.

Pin-ended.

Length: Tubing, 12 feet 9 inches; column, C to C of pins, 13 feet 4 inches.

Weight, 226½ pounds.

Sectional area, 5.23 square inches.

Thickness, ″.32 to ″.39.

Initial deflection: Horizontal, ″.08 to ″.14; vertical, ″.10.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0215	....	0.	.01	
52,300	10,000	.0427	.0010	.01	.11	
....	1,000	....	....	0.	.01	
78,450	15,000	.0605	....	.02	.14	
104,600	20,000	.0789	.0045	.03	.14	
....	1,000	....	....	0.	.02	
130,750	25,000	.1174	.0332	.06	.19	Snapping sounds.
....	1,000	....	....	.03	.04	
135,980	26,000	....	....	.10	.20	Scale starts off.
141,210	27,000	....	....	.20	.25	Ultimate strength.
Column deflected rapidly, springing laterally.						
83,600	....	....	....	1.38	.28	Load and deflections after springing.

Maximum deflection occurred about one-third distance from end of column.

No. 1942.

Lap-welded tubing, 5″ nominal diameter.
Pin-ended.
Length: Tubing, 12 feet 9 inches; columns, C to C of pins, 13 feet 4 inches.
Weight, 225 pounds.
Sectional area, 5.19 square inches.
Thickness of tubing, ″.33 to ″.39.
Initial deflection: Horizontal, ″.16; vertical, ″.12.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,190	1,000	0.	0.	0.	0.	Initial load.
25,950	5,000	.0127	....	0.	0.	
51,900	10,000	.0273	0.	.01	.01	
....	1,000	....	....	0.	0.	
77,850	15,000	.0432	....	.02	.02	
103,800	20,000	.0583	.0007	.03	.04	
....	1,000	....	....	0.	0.	
129,750	25,000	.0739	.0016	.04	.05	Scale starts.
....	1,000	....	....	.01	0.	
134,940	26,000	.0772	....	.05	.06	
140,130	27,000	.0803	....	.05	.07	
145,320	28,000	.0844	.0032	.06	.07	
....	1,000	....	....	.02	.01	
150,510	29,000	....	....	.07	.08	
155,700	30,000	....	....	.10	.15	Ultimate strength.
Rapid yielding occurred under the maximum stress, soon followed by sudden springing.						
83,400	....	....	....	1.77	.17	Load and deflections after sudden springing.

No. 1943.

Lap-welded tubing, 5″ nominal diameter.

Pin-ended.

Length: Tubing, 12 feet 9 inches; column, C to C of pins, 13 feet 4 inches.

Weight, 224½ pounds.

Sectional area, 5.18 square inches.

Thickness of tubing, ″.32 to ″.39.

Initial deflection: Horizontal, ″.06; vertical, ″.08.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,180	1,000	0.	0.	0.	0.	Initial load.
25,900	5,000	.0114	....	0.	.01	
51,800	10,000	.0269	0.	.01	.03	
....	1,000	....	....	0.	0.	
77,700	15,000	.0435	....	.02	.03	
103,600	20,000	.0585	.0003	.03	.03	
....	1,000	....	....	0.	0.	
129,500	25,000	.0742	.0002	.03	.04	
....	1,000	....	....	0.	0.	
134,680	26,000	.0775	....	.03	.04	
139,860	27,000	.0807	....	.03	.04	
145,040	28,000	.0844	....	.03	.05	
150,220	29,000	.0880	....	.03	.05	
155,400	30,000	.0916	.0012	.03	.05	
....	1,000	....	....	0.	.01	
160,580	31,000	....	....	.03	.06	
165,760	32,000	....	....	.14	.26	Ultimate strength.
81,400	....	....	....	1.98	.24	Load and deflections after sudden springing.

No. 1938.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 16 feet 6⅞ inches; column, C to C of pins, 17 feet 1⅞ inches.
Weight, 294 pounds.
Sectional area, 5.22 square inches.
Thickness of tubing, ″.34 to ″.39.
Initial deflections: Horizontal, ″.09; vertical, ″.09.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,220	1,000	0.	0.	0.	0.	Initial load.
26,100	5,000	.0139	0.	.02	0.	
52,200	10,000	.0305	.0008	.03	0.	
....	1,000	....	....	0.	0.	
78,300	15,000	.0476	....	.04	.01	
104,400	20,000	.0647	.0023	.05	.01	
....	1,000	....	....	0.	0.	
130,500	25,000	.0834	.0045	0.	.05	
....	1,000	....	....	− .03	.03	
141,000	27,010	....	....	....	....	Ultimate strength.
		Column deflected suddenly under maximum stress.				
51,000	....	....	....	−2.89	.26	Load and deflections after sudden springing.

No. 1939.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 16 feet 6⅞ inches; column, C to C of pins, 17 feet 1⅞ inches.
Weight, 299½ pounds.
Sectional area, 5.32 square inches.
Thickness of tubing, ″.34 to ″.40.
Initial deflection: Horizontal, ″.10; vertical, ″.15.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,320	1,000	0.	0.	0.	0.	Initial load.
26,600	5,000	.0127	....	.02	0.	
53,200	10,000	.0283	0.	.03	.01	
....	1,000	....	....	0.	0.	
79,800	15,000	.0329	....	.04	.02	
106,400	20,000	.0584	.0001	.06	.04	
....	1,000	....	....	0.	0.	
133,000	25,000	.0739	.0008	.07	.06	
1,000	....	....	....	.03	.01	
138,320	26,000	....	....	.08 .16	....	After sustaining load 8 minutes.
143,640	27,000	....	....	.19 .28	....	Ultimate strength.
Column sprung suddenly when horizontal deflection reached ″.28.						
53,600	....	....	....	2.88	0.	Load and deflections after sudden springing.

No. 1940.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 16 feet 6⅞ inches; column, C to C of pins, 17 feet 1⅞ inches.
Weight, 290½ pounds.
Sectional area, 5.16 square inches.
Thickness of tubing, ″.34 to ″.38.
Initial deflection: Horizontal, ″.09; vertical, ″.09.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,160	1,000	0.	0.	0.	0.	Initial load.
25,800	5,000	.0177	....	.01	.05	
51,600	10,000	.0348	.0016	.01	.06	
....	1,000	....	....	0.	.01	
77,400	15,000	.0522	....	0.	.08	
103,200	20,000	.0701	.0022	— .01	.08	
....	1,000	....	....	0.	.03	
129,000	25,000	.0880	.0029	— .03	.10	
....	1,000	....	....	0.	.03	
134,160	26,000	....	....	— .03	.10	
139,320	27,000	....	....	— .04	.10	
144,480	28,000	....	....	— .05	.11	
149,640	29,000	....	....	— .06	.16	
152,700	29,590	....	....	....	....	Ultimate strength.
Sudden springing under the maximum stress.						
55,500	....	....	....	—3.04	.39	Load and deflections after sudden springing.

No. 1935.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 20 feet ⅝ inch; column, C to C of pins, 20 feet 7⅝ inches.
Weight, 352 pounds.
Sectional area, 5.16 square inches.
Thickness of tubing, ″.32 to ″.39.
Initial deflection: Horizontal, ″.12 to ″.15; vertical, ″.11.
Short kinks in each at middle of length.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,160	1,000	0.	0.	0.	0.	Initial load.
25,800	5,000	.0136	....	.01	0.	
51,600	10,000	.0300	.0008	.03	.01	
....	1,000	....	....	0.	0.	
77,400	15,000	.0466	.0011	.06	.03	
....	1,000	....	....	0.	.01	
103,200	20,000	....	....	.09	.03	
129,000	25,000	....	....	.16	.04	
135,000	....	....	....	.18	.05	
140,000	....	....	....	.20	.06	
145,000	....	....	....	.24	.06	
148,500	28,780	....	....	....	....	Ultimate strength.
Sudden springing horizontally when maximum stress was reached.						
44,200	....	....	....	4.03	.06	Load sustained by column and deflections after sudden springing.

No. 1936.

Lap welded tubing, 5″ nominal diameter.

Pin ended.

Length: Tubing, 20 feet $\frac{5}{16}$ inch; column, C to C of pins, 20 feet $7\frac{5}{16}$ inches.

Weight, 347 pounds.

Sectional area, 5.10 square inches.

Thickness of tubing, ″.33 to ″.36.

Initial deflection: Horizontal, ″.12; vertical, ″.15.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,100	1,000	0.	0.	0.	0.	Initial load.
25,500	5,000	.0140	....	.02	.01	
51,000	10,000	.0306	.0007	.03	.01	
....	1,000	....	....	0.	0.	
76,500	15,000	.0465	....	.05	.02	
102,000	20,000	.0620	.0009	.10	.04	
....	1,000	....	....	.01	0.	
127,500	25,000	.0775	.0013	.18	.08	
....	1,000	....	....	.03	.01	
132,600	26,000	....	....	.31	....	Ultimate strength.
	Sudden springing horizontally when maximum stress was reached.					
41,500	....	....	....	3.62	.10	Load and deflections after sudden springing.

No. 1937.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 19 feet 11⅞ inches; column, C to C of pins, 20 feet 6⅞ inches.
Weight, 346 pounds.
Sectional area, 5.09 square inches.
Thickness of tubing, ″.33 to ″.37.
Initial deflection: Horizontal, ″.10; vertical, 0″.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,090	1,000	0.	0.	0.	0.	Initial load.
25,450	5,000	.0135	....	.01	0.	
50,900	10,000	.0306	.0002	.05	.01	
....	1,000	....	....	0.	0.	
76,350	15,000	.0463	....	.06	.02	
101,800	20,000	.0646	.0009	.11	.03	
....	1,000	....	....	0.	0.	
127,250	25,000	....	....	.21	.05	
....	1,000	....	....	.05	0.	
....	10,000	....	....	.10	.03	
....	20,000	....	....	.18	.05	
115,000	22,590	....	....	.20	....	
120,000	23,580	....	....	.21	....	
125,000	24,560	....	....	.23	....	
127,000	24,950	....	....	.24	....	
128,000	25,150	....	....	.25	....	
129,300	25,400	....	....	.26	....	
129,800	25,500	....	....	.27	....	
130,000	25,540	....	....	.30 .36	....	Ultimate strength.
Sudden springing occurred under maximum stress when horizontal deflection reached .36 inch.						
42,000	....	....	....	3.73	.07	Load and deflections after sudden springing.

No. 1932.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 23 feet 5 inches; column, C to C of pins, 24 feet 0 inch.
Weight, 401 pounds.
Sectional area, 5.04 square inches.
Thickness of tubing, ″.32 to ″.37.
Initial deflection: Horizontal, ″.12 to ″.24; vertical, ″.29.
Gauged length, 100″.
Short deflected sections in which the tubing was bent, ″.08 to ″.12; versed sine of chord, 24″. Four such short bends.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,040	1,000	0.	0.	0.	0.	Initial load.
25,200	5,000	.0132	....	0.	.02	
50,400	10,000	.0285	.0002	.03	.06	
....	1,000	....	....	0.	0.	
75,600	15,000	.0436	....	.12	.10	
97,600	19,370	....	....	....	....	Ultimate strength.
Sudden lateral deflection occurred when the maximum stress was reached. The load sustained by the tubing and the deflections after sudden springing laterally were as follows:						
45,000	....	....	....	3.71	.08	

No. 1933.

Lap welded tubing, 5″ nominal diameter.
Pin ended.
Length: Tubing, 23 feet 5 inches; column, C to C of pins, 24 feet 0 inch.
Weight, 401 pounds.
Sectional area, 5.04 square inches.
Thickness of tubing, ″.32 to ″.37.
Initial deflection: Horizontal, ″.13; vertical, ″.18.
Short deflections in tubing.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,040	1,000	0.	0.	0.	0.	Initial load.
25,200	5,000	.0123	....	.05	.07	
50,400	10,000	.0276	.0001	.11	.11	
....	1,000	....	....	0.	.03	
75,600	15,000	....	....	.21	.15	
96,500	19,150	....	....	....	....	Ultimate strength.
Tubing suddenly sprung laterally when maximum stress was reached.						
45,600	....	....	....	3.43	.23	Load and deflections after sudden springing.

The tubing deflected horizontally in the same direction as the original bends. After removal from the testing machine the permanent horizontal deflection was .22 inch against .13 inch initial deflection.

No. 1934.

Lap welded tubing, 5'' nominal diameter.
Pin ended.
Length: Tubing, 23 feet 5 inches; column, C to C of pins, 24 feet 0 inch.
Weight, 402 pounds.
Sectional area, 5.05 square inches.
Thickness of tubing, ''.33 to ''.38.
Initial deflection: Horizontal, ''.15; vertical, ''.02.
Short deflected sections in tubing.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,050	1,000	0.	0.	0.	0.	Initial load.
25,250	5,000	.0140	....	0.	.02	
50,500	10,000	.0313	.0002	.01	.02	
....	1,000	....	....	0.	0.	
75,750	15,000	....	....	.02	.02	
95,500	....	....	....	.03	....	
97,000	....	....	....	.04	−.02	
98,000	....	....	....	.04	−.02	
100,800	....	....	....	.04	−.03	
105,000	....	....	....	.04	−.03	
110,880	....	....	....	.05	−.04	
115,920	....	....	....	.06	−.07	
120,000	....	....	....	.08	−.10	
125,300	24,810	....	....	.38	....	Ultimate strength.
Tubing increased the horizontal deflection rapidly as the maximum stress was reached. When the deflection reached ''.38 the column sprung suddenly, after which the load sustained and the deflections were as follows:						
....	35,800	....	....	4.46	.08	

Test discontinued and column removed from the testing machine.

FIXED END TESTS.

Tests Nos. 1953 to 1961, inclusive, were made with ends of tubing secured in special castings 18 inches diameter of base.

Tests Nos. 1962 to 1979, inclusive, were made with the ends of the tubing clamped in the jaws of the testing machine.

No. 1977.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 5 feet 10½ inches; between end blocks, 3 feet 6½ inches.
Weight, 104 pounds.
Sectional area, 5.21 square inches.
Thickness of tubing, ″.33 to ″.38.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
174,000	33,400					Scale starts off tubing.
215,500	41,360					Ultimate strength.

Failed by triple flexure.

No. 1978.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 5 feet 10$\frac{7}{16}$ inches; between end blocks, 3 feet 6$\frac{7}{16}$ inches.
Weight, 104½ pounds.
Sectional area, 5.24 square inches.
Thickness of tubing, ″.33 to ″.38.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
107,000	32,440					Scale starts off tubing.
215,200	41,070					Ultimate strength.

Failed by triple flexure.

No. 1979.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 5 feet $10\frac{7}{16}$ inches; between end blocks, 3 feet $6\frac{7}{16}$ inches.
Weight, 105 pounds.
Sectional area, 5.26 square inches.
Thickness of tubing, ″.32 to ″.42.
Initial deflection, ″.04 short bend.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
175,000	33,270	....	....	....	....	Scale starts off tubing.
226,300	43,020	....	....	....	....	Ultimate strength.

Failed by triple flexure.

No. 1974.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 8 feet $3\frac{7}{8}$ inches; between end blocks, 5 feet $11\frac{7}{8}$ inches.
Weight, 149 pounds.
Sectional area, 5.27 square inches.
Thickness of tubing, ″.33 to ″.40.
Initial deflection: Horizontal, ″.08; vertical, 0″.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,270	1,000	0.	0.	0.	0.	Initial load.
26,350	5,000	.0067	....	0.	0.	
52,700	10,000	.0154	0.	0.	0.	
79,050	15,000	.0235	....	0.	0.	
105,400	20,000	.0328	.0013	0.	0.	
....	1,000	....	....	0.	0.	
131,750	25,000	.0430	.0029	0.	0.	
....	1,000	....	....	0.	0.	
137,020	26,000	.0454	....	0.	0.	
142,290	27,000	.0476	....	0.	0.	
147,560	28,000	.0506	....	0.	0.	
152,830	29,000	.0525	....	.01	0.	
158,100	30,000	.0566	.0099	.02	0.	
....	1,000	....	....	.01	0.	
163,370	31,000	.0664	....	.04	0.	
168,640	32,000	.1115	....	.31 .70	.05 .15	Ultimate strength.

Failed by triple flexure.

No. 1975.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 8 feet $3\frac{15}{16}$ inches; between end blocks, 5 feet $11\frac{15}{16}$ inches.
Weight, 148 pounds.
Sectional area, 5.23 square inches.
Thickness of tubing, ″.33 to ″.39.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0069	....	0.	0.	
52,300	10,000	.0158	.0004	0.	0.	
....	1,000	....	....	0.	0.	
78,450	15,000	.0237	....	0.	0.	
104,600	20,000	.0325	.0010	0.	0.	
....	1,000	....	....	0.	0.	
130,750	25,000	.0419	.0015	0.	0.	
....	1,000	....	....	0.	0.	
135,980	26,000	.0437	....	0.	0.	
141,210	27,000	.0453	....	0.	0.	
146,440	28,000	.0470	....	0.	0.	
151,670	29,000	.0488	....	0.	0.	
156,900	30,000	.0508	.0027	.01	0.	
....	1,000	....	....	.01	.01	
162,130	31,000	.0530	.0530	.01	.01	
167,360	32,000	.0555	....	.01	.01	
172,590	33,000	.0682	....	.11 .35	.02 .06	Ultimate strength.

No. 1976.

Lap welded tubing, 5″ nominal diameter.

Fixed ends.

Length: Tubing, 8 feet 3⅞ inches; between end blocks, 5 feet 11⅞ inches.

Weight, 149 pounds.

Sectional area, 5.27 square inches.

Thickness of tubing, ″.32 to ″.39.

Initial deflection: Horizontal, 0″; vertical, 0″.

Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,270	1,000	0.	0.	0.	0.	Initial load.
26,350	5,000	.0068	....	0.	0.	
52,700	10,000	.0160	.0004	0.	0.	
....	1,000	....	....	0.	0.	
79,050	15,000	.0242	....	0.	0.	
105,400	20,000	.0334	.0020	0.	0.	
....	1,000	....	....	0.	0.	
131,750	25,000	.0438	.0036	0.	.01	
....	1,000	....	....	0.	0.	
137,020	26,000	.0458	....	0.	.01	
142,290	27,000	.0478	....	0.	.01	
147,560	28,000	.0500	....	0.	.01	
152,830	29,000	.0518	....	0.	.01	
158,100	30,000	.0556	.0084	.01	.01	
....	1,000	....	....	0.	0.	
163,370	31,000	.1176	....	.13	.17	Ultimate strength.

Failed by triple flexure.

No. 1973.

Lap welded tubing, 5″ nominal diameter.

Fixed ends.

Length: Tubing, 11 feet 8⅞ inches; between end blocks, 9 feet 4⅞ inches.

Weight, 202 pounds.

Sectional area, 5.06 square inches.

Thickness of tubing, ″.32 to ″.36.

Initial deflection: Horizontal, ″.08; vertical, ″.06.

Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,060	1,000	0.	0.	0.	0.	Initial load.
25,300	5,000	.0065	....	0.	0.	
50,600	10,000	.0154	0.	0.	0.	
....	1,000	....	....	0.	0.	
75,900	15,000	.0235	....	0.	0.	
101,200	20,000	.0324	.0008	0.	0.	
....	1,000	....	....	0.	0.	
126,500	25,000	.0418	.0020	0.	0.	
....	1,000	....	....	0.	0.	
131,560	26,000	.0440	....	0.	0.	
136,620	27,000	.0459	....	0.	0.	
141,680	28,000	.0480	....	0.	0.	
146,740	29,000	.0504	....	0.	0.	
151,800	30,000	.0539	.0061	0.	0.	
....	1,000	....	....	0.	0.	
156,860	31,000	.0684	....	.02 .14	.01 .13	Ultimate strength.

Failed by triple flexure.

No. 1968.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 15 feet 1¾ inches; between end blocks, 12 feet 9¾ inches.
Weight, 264 pounds.
Sectional area, 5.13 square inches.
Thickness of tubing, ″.34 to ″.37.
Initial deflection: Horizontal, ″.11; vertical, ″.04.
Gauged length, 100″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,130	1,000	0.	0.	0.	0.	Initial load.
25,650	5,000	.0132	....	....	....	
51,300	10,000	.0301	....	.01	0.	
....	1,000	....	....	0.	0.	
76,950	15,000	.0470	....	.01	0.	
102,600	20,000	.0667	.0008	.02	0.	
....	1,000	....	....	0.	0.	
128,250	25,000	.0820	.0021	.02	.01	
....	1,000	....	....	0.	0.	
133,380	26,000	.0857	....	.02	.01	
138,510	27,000	.0897	....	.02	.01	
143,640	28,000	.0941	....	.03	.01	
148,770	29,000	.0992	....	.03	.02	
153,900	30,000	.1056	.0077	.03	.04	
....	1,000	....	....	.01	.02	
159,030	31,000	.1165	....	.05	.10	Ultimate strength.

Failed by triple flexure.

No. 1969.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 15 feet 1¾ inches; between end blocks, 12 feet 9¾ inches.
Sectional area, 5.26 square inches.
Thickness of tubing, ″.32 to ″.40.
Initial deflection: Horizontal, ″.04; vertical, 0″.
Gauged length, 100″.
Short bend initially in part covered by one set of end blocks.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,260	1,000	0.	0.	0.	0.	Initial load.
26,300	5,000	.0132	....	....	....	
52,600	10,000	.0302	.0002	....	....	
....	1,000	....	....	0.	0.	
78,900	15,000	.0473	....	0.	.01	
105,200	20,000	.0643	.0009	0.	.01	
....	1,000	....	....	0.	0.	
131,500	25,000	.0838	.0031	.01	.02	
....	1,000	....	....	0.	.01	
136,760	26,000	.0818	....	.01	.03	
142,020	27,000	.0925	....	.01	.03	
147,280	28,000	.0978	....	.01	.04	
152,540	29,000	.1062	....	.02	.06	
157,800	30,000	.1255	.0304	.02	.14	Ultimate strength.
....	1,000	....	....	.01	.12	

Failed by triple flexure.

No. 1970.

Lap-welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 15 feet 1¾ inches; between end blocks, 12 feet 9¾ inches.
Weight, 259 pounds.
Sectional area, 5.03 square inches.
Thickness of tubing, ″.33 to ″.38.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, 100″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,030	1,000	0.	0.	0.	0.	Initial load.
25,150	5,000	.0133	....	0.	0.	
50,300	10,000	.0300	0.	0.	0.	
....	1,000	....	....	0.	0.	
75,450	15,000	.0465	....	0.	0.	
100,600	20,000	.0630	.0004	0.	0.	
....	1,000	....	....	0.	0.	
125,750	25,000	.0813	.0020	0.	0.	
....	1,000	....	....	0.	0.	
130,780	26,000	.0846	....	0.	0.	
135,810	27,000	.0882	....	0.	.01	
140,840	28,000	.0917	....	.01	.01	
145,870	29,000	.0965	....	.02	.01	
150,900	30,000	.1001	.0037	.02	.01	
155,930	31,000	.1048	....	.03	.01	
160,960	32,000	.1104	....	.04	.02	
165,000	32,800	....	....	....	....	Ultimate strength.

Failed by triple flexure.

No. 1959.

Lap-welded tubing, 5″ nominal diameter.

Fixed ends.

Length: Tubing, 18 feet 7 inches; between end blocks, 16 feet 7.90 inches.

Weight, 330½ pounds.

Sectional area, 5.23 square inches.

Thickness of tubing, ″.34 to ″.38.

Initial deflection: Horizontal, ″.10; vertical, ″.12.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,230	1,000	0.	0.	0.	0.	Initial load.
26,150	5,000	.0174	....	....	.06	
52,300	10,000	.0363	.0008	....	.08	
....	1,000	....	....	0.	0.	
78,450	15,000	.0553	....	....	.11	
104,600	20,000	.0739	.0012	.01	.13	
....	1,000	....	....	0.	.01	
130,750	25,000	.0958	.0028	.02	.19	
....	1,000	....	....	0.	.02	
135,980	26,000	.1011	....	.02	.21	
141,210	27,000	.1063	....	.02	.23	
146,440	28,000	.1130	....	.03	.26	
151,670	29,000	.0220	....	.06	.33	Ultimate strength.
....	1,000	....	....	.03	.16	

Failed by triple flexure.

No. 1960.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 18 feet 6⅞ inches; between end blocks, 16 feet 7.32 inches.
Weight, 325 pounds.
Sectional area, 5.15 square inches.
Thickness of tubing, ″.33 to ″.38.
Initial deflection: Horizontal, ″.08: vertical, ″.25.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,150	1,000	0.	0.	0.	0.	Initial load.
25,750	5,000	.0108	....	.04	.06	
51,500	10,000	.0263	.0012	.05	.09	
....	1,000	....	....	.02	.04	
77,250	15,000	.0422	....	.07	.11	
103,000	20,000	.0572	.0010	.07	.14	
....	1,000	....	....	.03	.05	
128,750	25,000	.0690	.0022	.10	.24	
....	1,000	....	....	.05	.14	
133,200	25,860	....	....	....	....	Ultimate strength.
96,000	....	....	....	.62	2.24	Load and deflections after passing the maximum stress.

Failed by triple flexure.

No. 1961.

Lap welded tubing, 5'' nominal diameter.
Fixed ends.
Length: Tubing, 18 feet 6⅞ inches; between blocks, 16 feet 7.4 inches.
Weight, 320 pounds.
Sectional area, 5.07 square inches.
Thickness of tubing, ''.32 to ''.37.
Initial deflection: Horizontal, ''.08; vertical, ''.21.
Gauged length, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,070	1,000	0.	0.	0.	0.	Initial load.
25,350	5,000	.0102	....	....	.05	
50,700	10,000	.0258	.0005	....	.07	
....	1,000	....	....	0.	.02	
76,050	15,000	.0409	....	....	.08	
101,400	20,000	.0562	.0008	.01	.10	
....	1,000	....	....	0.	.02	
126,750	25,000	.0718	.0016	.02	.12	
....	1,000	....	....	0.	.02	
131,820	26,000	.0759	....	.03	.13	
136,890	27,000	.0787	....	.04	.14	
141,960	28,000	.0812	.0019	.05	.17	
....	1,000	....	....	.02	.07	
147,030	29,000	....	....	.26	.37	Ultimate strength.

Failed by triple flexure.

No. 1965.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 19 feet 11¾ inches; between end blocks, 17 feet 7¾ inches.
Weight, 357½ pounds.
Sectional area, 5.27 square inches.
Thickness of tubing, ″.33 to ″.37.
Initial deflection: Horizontal, ″.06; vertical, ″.06.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,270	1,000	0.	0.	0.	0.	Initial load.
26,350	5,000	.0134	....	....	....	
52,700	10,000	.0310	.0002	....	....	
....	1,000	....	....	0.	0.	
79,050	15,000	.0485	....	.01	.01	
105,400	20,000	.0663	.0010	.02	.04	
....	1.000	....	....	0.	0.	
110.670	21.000	.0703	....	.03	.05	
115.940	22.000	.0740	....	.03	.05	
121.210	23.000	.0780	....	.04	.05	
126.480	24.000	.0820	....	.04	.06	
131.750	25.000	.0868	.0035	.05	.07	
....	1.000	....	....	.02	.02	
137.020	26.000	.0923	....	.06	.09	
142.290	27.000	.1005	....	.09	.11	
....	1.000	....	....	.06	.05	
147.560	28.000	....	....	.16	.20	Ultimate strength.

Failed by triple flexure.

No. 1966.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 19 feet 7 inches; between end blocks, 17 feet 3 inches.
Weight, 345 pounds.
Sectional area, 5.18 square inches.
Thickness of tubing, ″.32 to ″.38.
Initial deflection: Horizontal, ″.16; vertical, ″.04.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,180	1,000	0.	0.	0.	0.	Initial load.
25,900	5,000	.0134	....	.01	....	
51,800	10,000	.0309	.0002	.02	....	
....	1,000	....	....	0.	0.	
77,700	15,000	.0480	....	.04	.01	
103,600	20,000	.0650	.0011	.06	.03	
....	1,000	....	....	0.	0.	
108,780	21,000	.0688	....	.07	.03	
113,960	22,000	.0723	....	.07	.03	
119,140	23,000	.0761	....	.08	.04	
124,320	24,000	.0800	....	.09	.04	
129,500	25,000	.0840	.0026	.09	.04	
....	1,000	....	....	.01	.02	
134,680	26,000	.0880	....	.10	.05	
139,860	27,000	.0928	....	.12	.06	
145,040	28,000	.0981	.0054	.15	.07	
....	1,000	....	....	.03	.04	
150,220	29,000	....	....	.19	.09	
154,500	29,830	....	....	.43	.30	Ultimate strength.

Failed by triple flexure.

No. 1967.

Lap welded tubing, 5″ nominal diameter.

Fixed ends.

Length: Tubing, 19 feet 6⅞ inches; between end blocks, 17 feet 2⅞ inches.

Weight, 346 pounds.

Sectional area, 5.20 square inches.

Thickness of tubing, ″.32 to ″.40.

Initial deflection: Horizontal, ″.01; vertical, ″.05.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,200	1,000	0.	0.	0.	0.	Initial load.
26,000	5,000	.0128	....	....	....	
52,000	10,000	.0289	.0001	0.	.02	
....	1,000	....	....	0.	0.	
78,000	15,000	.0447	....	0.	.03	
104,000	20,000	.0604	.0005	0.	.04	
....	1,000	....	....	0.	0.	
109,200	21,000	.0634	....	0.	.04	
114,400	22,000	.0666	....	0.	.04	
119,600	23,000	.0698	....	0.	.04	
124,800	24,000	.0728	....	.01	.05	
130,000	25,000	.0758	.0006	.01	.06	
135,200	26,000	.0787	....	.01	.06	
140,400	27,000	.0812	....	.01	.07	
145,600	28,000	.0827	....	.02	.11	
150,800	29,000	.0890	.0043	.04	.19	Ultimate strength.
....	1,000	....	....	0.	.10	

Failed by triple flexure.

No. 1962.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 21 feet 11⅞ inches; between end blocks, 19 feet 7⅞ inches.
Weight, 386 pounds.
Sectional area, 5.16 square inches.
Thickness of tubing, ″.33 to ″.37.
Initial deflection: Horizontal, ″.07; vertical, 0.″
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,160	1,000	0.	0.	0.	0.	Initial load.
25,800	5,000	.0136	....	....	....	
51,600	10,000	.0307	.0008	....	....	
....	1,000	....	....	0.	0.	
77,400	15,000	.0479	....	....	....	
103,200	20,000	.0657	.0020	0.	.01	
108,360	21,000	.0708	....	0.	.02	
113,520	22,000	.0746	....	0.	.03	
118,680	23,000	.0786	....	0.	.04	
123,840	24,000	.0822	....	0.	.05	
129,000	25,000	.0859	.0045	0.	.06	
....	1,000	....	....	0.	.02	
134,160	26,000	.0903	....	0.	.06	
139,320	27,000	.0955	....	0.	.07	
144,480	28,000	.1063	.0044	.09	.10	Ultimate strength.
....	1,000	....	....	.06	.04	
100,000	....	....	....	2.23	.33	

Failed by triple flexure.

No. 1963.

Lap welded tubing, 5″ nominal diameter.

Fixed ends.

Length: Tubing, 22 feet 0 inch; between end blocks, 19 feet 8 inches.

Weight, 383 pounds.

Sectional area, 5.12 square inches.

Thickness of tubing, ″.33 to ″.37.

Initial deflection: Horizontal, ″.08; vertical, ″.06.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,120	1,000	0.	0.	0.	0.	Initial load.
25,600	5,000	.0134	....	.01	0.	
....	1,000	....	....	0.	0.	
51,200	10,000	.0308	.0006	.02	....	
76,800	15,000	.0482	....	.02	....	
102,400	20,000	.0654	.0018	.03	.01	
....	1,000	....	....	0.	0.	
107,520	21,000	.0695	....	.03	.01	
112,640	22,000	.0732	....	.03	.01	
117,760	23,000	.0772	....	.03	.02	
122,880	24,000	.0809	....	.04	.02	
128,000	25,000	.0844	.0034	.04	.02	
....	1,000	....	....	0.	0.	
133,120	26,000	.0884	....	.04	.02	
138,240	27,000	.0921	....	.06	.02	
143,360	28,000	.0962	.0063	.11	.02	
....	1,000	....	....	.04	.02	
145,100	28,340	....	....	.41	.32	Ultimate strength.

Failed by triple flexure.

57.

, 20 feet 1.1

			Remarks.
		ch.	
		0.	Initial load.
		.01	
		.01	
		0.	
		0.	
	...	.01	
		0.	
	..	.02	
	0.	.02	
	0.	.03	
	....	.03	
	....	.04	
	....	.01	
. .	.01	.05	
	.02	.06	
.....	0.	.01	
......	.02	.06	
....	.02	.08	
.0023	.02	.09	
....	0.	0.	
....	.05	.20	Ultimate strength.
....	abt. 85	3.53	Load and deflections after passing the maximum resistance.

ained in full contact with the platforms of the
ntil after passing the maximum load.

No. 1956.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 21 feet 11⅞ inches; between end blocks, 20 feet 0.85 inches.
Weight, 386 pounds.
Sectional area, 5.16 square inches.
Thickness of tubing, ″.33 to ″.37.
Initial deflection: Horizontal, ″.13; vertical, ″.22.
Gauged length, 100″.
Severe gagging had been done in eight places.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,160	1,000	0.	0.	0.	0.	Initial load.
25,800	5,000	.0163	....	.02	.05	
51,600	10,000	.0351	.0010	.03	.09	
....	1,000	....	....	.01	.01	
77,400	15,000	.0544	....	.05	.13	
103,200	20,000	.0743	.0017	.07	.19	
108,360	21,000	.0788	....	.08	.21	
113,520	22,000	.0829	....	.08	.22	
118,680	23,000	.0882	....	.09	.25	
123,840	24,000	.0932	....	.10	.29	
129,000	25,000	.1100	.0184	.12	.44	Ultimate strength.
....	1,000	....	....	.07	.23	

Failed by triple flexure.

No. 1957.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 22 feet ⅛ inch; between end blocks, 20 feet 1.1 inches.
Weight, 385 pounds.
Sectional area, 5.15 square inches.
Thickness of tubing, ″.32 to ″.39.
Initial deflection: Horizontal, ″.08; vertical, ″.22.
Gauged length, 100″.
Severe gagging had been done in six places.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,150	1,000	0.	0.	0.	0.	Initial load.
25,750	5,000	.0137	....	....	.01	
51,500	10,000	.0311	....	....	.01	
....	1,000	....	....	0.	0.	
77,250	15,000	.0482	....	0.	0.	
103,000	20,000	.0664	.0001	....	.01	
....	1,000	....	....	0.	0.	
108,150	21,000	.0701	....	0.	.02	
113,300	22,000	.0734	....	0.	.02	
118,450	23,000	.0771	....	0.	.03	
123,600	24,000	.0812	....	....	.03	
128,750	25,000	.0848	.0007	....	.04	
....	1,000	....	....	....	.01	
133,900	26,000	.0885	....	.01	.05	
139,050	27,000	.0925	.0158	.02	.06	
....	1,000	....	....	0.	.01	
144,200	28,000	.0965	....	.02	.06	
149,350	29,000	.1007	....	.02	.08	
154,500	30,000	.1057	.0023	.02	.09	
....	1,000	....	....	0.	0.	
159,650	31,000	.1144	....	.05	.20	Ultimate strength.
100,000	....	....	....	abt. 85	3.53	Load and deflections after passing the maximum resistance.

End blocks remained in full contact with the platforms of the testing machine until after passing the maximum load.

No. 1958.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 22 feet 0 inch; between end blocks, 20 feet .85 inch.
Weight, 382 pounds.
Sectional area, 5.11 square inches.
Thickness of tubing, ″.32 to ″.38.
Initial deflection: Horizontal, ″.14; vertical, ″.18.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,110	1,000	0.	0.	0.	0.	Initial load.
25,550	5,000	.0141	....	.01	....	
51,100	10,000	.0324	.0005	.03	.02	
....	1,000	....	....	0.	0.	
76,650	15,000	.0506	....	.06	.04	
102,200	20,000	.0696	.0010	.09	.08	
....	1,000	....	....	.01	0.	
107,310	21,000	.0740	....	.10	.09	
112,420	22,000	.0783	....	.11	.10	
117,530	23,000	.0828	....	.14	.12	
122,640	24,000	.0881	....	.24	.14	
127,750	25,000	.0946	.0035	.27	.19	
....	1,000	....	....	.13	.05	
132,860	26,000	....	....	.29	.24	
137,500	26,910	....	....	....	....	Ultimate strength.
110,000	....	....	....	.84	1.40	Load and deflections after passing maximum stress. Failed by triple flexure.

No. 1953.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 23 feet ⅜ inch; between end blocks, 21 feet ¾ inch.
Weight, 400 pounds.
Sectional area, 5.11 square inches.
Thickness of tubing, ″.31 to ″.42.
Initial deflection: Horizontal, ″.13 and ″.04 ±; vertical, ″.35.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,110	1,000	0.	0.	0.	0.	Initial load.
25,550	5,000	.0105	....	.01	.07	
51,100	10,000	.0261	.0002	.02	.14	
....	1,000	....	....	0.	.01	
76,650	15,000	.0392	....	.05	.21	
102,200	20,000	.0506	.0008	.08	.31	
....	1,000	....	0.	.03	....	
107,310	21,000	.0521	....	.09	.34	
112,420	22,000	.0533	....	.09	.38	
117,530	23,000	.0545	....	.11	.44	
122,640	24,000	.0538	....	.11	.52	
127,750	25,000	.0495	.0013	.11	.64	
....	1,000	....	....	0.	.12	
129,200	25,280	....	....	.19	1.36	Ultimate strength.

Failed by triple flexure.

Ends of tubing forced along end blocks, and found projected about $\frac{1}{16}$ inch beyond end faces of same, when column was removed from testing machine.

No. 1954.

Lap welded tubing, 5″ nominal diameter.

Fixed ends.

Length: Tubing, 23 feet $5\frac{5}{16}$ inches; between end blocks, 21 feet 5.7 inches.

Weight, 403½ pounds.

Sectional area, 5.06 square inches.

Thickness of tubing, ″.32 to ″.37.

Initial deflection: Horizontal, ″.16; vertical, ″.22.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,060	1,000	0.	0.	0.	0.	Initial load.
25,300	5,000	.0167	....	.03	.03	
50,600	10,000	.0352	.0009	.03	.06	
....	1,000	....	....	.02	.01	
75,900	15,000	.0548	....	.03	.12	
101,200	20,000	.0760	.0010	.02	.20	
....	1,000	....	....	.02	.02	
106,260	21,000	.0808	....	.02	.22	
111,320	22,000	.0850	....	.02	.24	
116,380	23,000	.0897	....	.01	.27	
121,440	24,000	.0951	....	.01	.30	
126,500	25,000	.1018	.0030	0.	.34	
....	1,000	....	....	0.	.04	
131,560	26,000	....	....	.04	.60	Ultimate strength.

Failed by triple flexure.

Tubing advanced and projected ″.08 to ″.10 beyond faces of end blocks.

No. 1955.

Lap welded tubing, 5″ nominal diameter.
Fixed ends.
Length: Tubing, 23 feet ¼ inch; between end blocks, 21 feet $\frac{9}{10}$ inch.
Weight, 393 pounds.
Sectional area, 5.02 square inches.
Thickness of tubing, ″.32 to ″.41.
Initial deflection: Horizontal, ″.14; vertical, ″.35.
Gauged length, 100″.
Severe gagging had been done in nine places.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
5,020	1,000	0.	0.	0.	0.	Initial load.
25,100	5,000	.0112	....	.02	.07	
50,200	10,000	.0273	.0017	....	.10	
....	1,000	....	....	0.	.07	
75,300	15,000	.0436	....	0.	.13	
100,400	20,000	.0588	.0019	.01	.15	
....	1,000	....	....	0.	.09	
105,420	21,000	.0613	....	.01	.18	
110,440	22,000	.0644	....	.01	.18	
115,460	23,000	.0677	....	.01	.19	
120,480	24,000	.0702	....	.02	.20	
125,500	25,000	.0729	.0017	.02	.22	
....	1,000	....	....	0.	.11	
130,520	26,000	.0756	....	.03	.25	
135,540	27,000	....	....	.03	.28	
140,560	28,000	....	....	.05	.35	
145,000	28,880	....	....	....	....	Ultimate strength.
110,000	....	....	....	.08	1.45	Load and deflections after passing maximum stress and after rapid lateral yielding.

TABULATION OF COMPRESSION TESTS OF LAP WELDED STEEL TUBING.

SPHERICAL ENDS.

Number of test.	Lengths.			Sectional area.	Ultimate strength.	
	Feet.	Inches.	$\frac{l}{r}$		Total.	Per square inch.
				Sq. in.	*Pounds.*	*Pounds.*
1929	3	½	22	5.20	298,000	57,200
1930	3	½	22	5.15	296,000	57,480
1931	3	½	22	5.21	306,800	58,890
1926	6	5½	47	5.23	183,050	35,000
1927	6	5½	47	5.23	176,000	33,650
1928	6	7½	48	5.23	176,800	33,800
1923	9	10¼	72	5.15	178,200	34,600
1924	9	10¼	72	5.22	172,260	35,000
1925	9	10¼	72	5.09	176,800	34,730
1920	13	3⅞	97	5.19	166,080	32,000
1921	13	4	97	5.25	158,400	30,170
1922	13	4	97	5.14	152,700	29,710
1917	17	1¼	125	5.19	150,000	28,900
1918	16	$6\frac{1}{16}$	121	5.22	140,940	27,000
1919	17	1½	125	5.04	151,200	30,000
1914	20	7¼	150	5.13	122,900	23,960
1915	20	6¼	150	5.09	136,200	26,760
1916	20	7¼	150	5.20	143,000	27,610
1911	24	¼	175	5.13	133,380	26,000
1912	24	¼	175	5.10	127,100	24,920
1913	24	¼	175	5.23	139,300	26,630

PIN ENDS.

Number of test.	Feet.	Inches.	$\frac{l}{r}$	Sectional area.	Total.	Per square inch.
1950	3	½	22	5.26	306,000	58,170
1951	3	½	22	5.21	284,000	54,510
1952	3	½	22	5.21	310,800	59,650
1947	6	5¼	47	5.18	173,400	33,470
1948	6	5¼	47	5.13	179,550	35,000
1949	6	5½	47	5.21	185,400	35,590
1944	9	10¼	72	5.34	160,200	30,000
1945	9	10¼	72	5.24	167,680	32,000
1946	9	10¼	72	5.26	167,300	31,810
1941	13	4	97	5.23	141,210	27,000
1942	13	4	97	5.19	155,700	30,000
1943	13	4	97	5.18	165,760	32,000
1938	17	1⅞	125	5.22	141,000	27,010
1939	16	6⅞	121	5.32	143,640	27,000
1940	16	6⅞	121	5.16	152,700	29,590
1935	20	⅞	146	5.16	148,500	28,780
1936	20	$\frac{1}{16}$	146	5.10	132,600	26,000
1937	19	11⅞	146	5.09	130,000	25,540
1932	24	0	175	5.04	97,600	19,370
1933	24	0	175	5.04	96,500	19,150
1934	24	0	175	5.05	125,300	24,810

TABULATION OF COMPRESSION TESTS OF LAP WELDED STEEL TUBING—Continued.

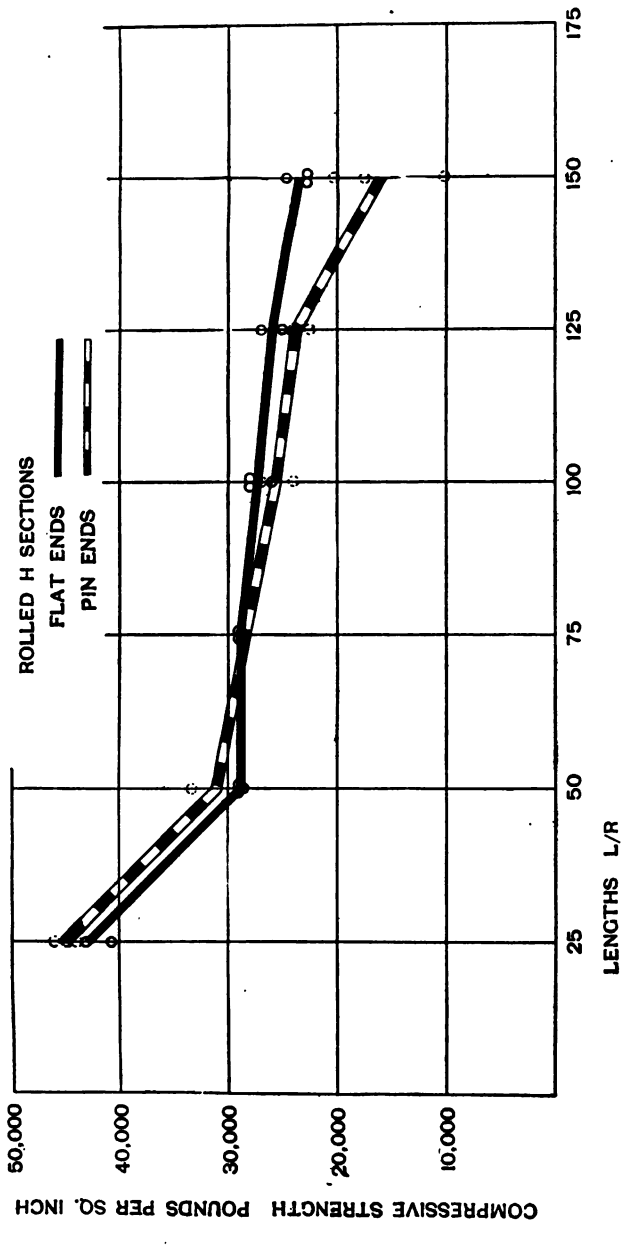
FIXED ENDS.

Number of test.	Lengths.			Sectional area.	Ultimate strength.	
	Feet.	Inches.	$\frac{l}{r}$		Total.	Per square inch.
				Sq. in.	*Pounds.*	*Pounds.*
1977	3	$6\frac{1}{2}$	26	5.21	215,500	41,360
1978	3	$6\frac{7}{16}$	26	5.24	215,200	41,070
1979	3	$6\frac{7}{16}$	26	5.26	226,300	43,020
1974	5	$11\frac{7}{8}$	44	5.27	168,640	32,000
1975	5	$11\frac{15}{16}$	44	5.23	172,590	33,000
1976	5	$11\frac{7}{8}$	44	5.27	163,370	31,000
1971	9	$4\frac{7}{8}$	69	5.06	166,980	33,000
1972	9	5	69	5.08	182,880	36,000
1973	9	$4\frac{7}{8}$	69	5.06	156,860	31,000
1968	12	$9\frac{3}{4}$	93	5.13	159,030	31,000
1969	12	$9\frac{3}{4}$	93	5.26	157,800	30,000
1970	12	$9\frac{3}{4}$	93	5.03	165,000	32,800
1959	16	7.90	121	5.23	151,670	29,000
1960	16	7.32	121	5.15	133,200	25,860
1961	16	7.4	121	5.07	147,030	29,000
1965	17	$7\frac{3}{4}$	128	5.27	147,560	28,000
1966	17	3	128	5.18	154,500	29,830
1967	17	$2\frac{7}{8}$	128	5.20	150,800	29,000
1962	19	$7\frac{7}{8}$	143	5.16	144,480	28,000
1963	19	8	143	5.12	145,100	28,340
1964	19	8	143	5.07	136,890	27,000
1956	20	0.85	146	5.16	129,000	25,000
1957	20	1.1	146	5.15	159,650	31,000
1958	20	0.85	146	5.11	137,500	26,910
1953	21	$\frac{3}{4}$	154	5.11	129,200	25,280
1954	21	5.7	157	5.06	131,560	26,000
1955	21	$\frac{9}{16}$	154	5.02	145,000	28,880

ROLLED H SECTIONS, STEEL.

COMPRESSION TESTS.

Dimensions of rolled sections:—Width of flanges, nominally, 6″; depth of section, nominally, 6″.



ROLLED H SECTIONS.

CURVES OF COMPRESSIVE STRENGTH, FLAT AND PIN ENDS.

ROLLED H SECTIONS, STEEL.

PIN END TESTS.

Diameter of pins, 3''.00.
Diameter of seats, 3$\frac{1}{64}$''.
Pins in plane of web of rolled section.
Tested with pins in a vertical position.
Nominal weight of rolled section, 23.8 pounds per foot.
Nominal sectional area, 7''.00.
Least radius of gyration, 1''.54.

SCHEDULE OF LENGTHS.

3 feet 2½ inches	25 l/r
6 feet 5 inches	50 l/r
9 feet 7½ inches	75 l/r
12 feet 10 inches	100 l/r
16 feet ½ inch	125 l/r
19 feet 3 inches	150 l/r

No. 1995.

Rolled H section.
Pin ends.
Length: Of rolled section, 2 feet 5½ inches; of column, C to C of pins, 3 feet 2½ inches.
Weight, 61 pounds.
Sectional area, 7.30 square inches.
Gauged length, 20''.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,300	1,000	0.	0.			Initial load.
36,500	5,000	.0007				
73,000	10,000	.0030	0.			
109,500	15,000	.0066				
146,000	20,000	.0100	.0002			
182,500	25,000	.0142	.0002			
189,800	26,000	.0152				
197,100	27,000	.0168				
204,400	28,000	.0184				
211,700	29,000	.0210				
219,000	30,000	.0228	.0035			Elastic limit.
226,300	31,000	.0306				
233,600	32,000	.23				
240,900	33,000	.26				
248,200	34,000	.28				
255,500	35,000	.30				
262,800	36,000	.32				
270,100	37,000	.35				
277,400	38,000	.38				
284,700	39,000	.41				
292,000	40,000	.45				
299,300	41,000	.49				
306,600	42,000	.54				
313,900	43,000	.58				
321,200	44,000	.64				
328,500	45,000	.78				Ultimate strength.

Failed by buckling of the flanges.

No. 1996.

Rolled H section.

Pin ends.

Length: Of rolled section, 2 feet 5½ inches; of column, C to C of pins, 3 feet 2½ inches.

Weight, 60 pounds.

Sectional area, 7.18 square inches.

Gauged length, 20″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,180	1,000	0.	0.	0.	0.	Initial load.
35,900	5,000	.0008	....	....	....	
71,800	10,000	.0038	0.	....	....	
107,700	15,000	.0079	....	....	....	
143,600	20,000	.0101	0.	....	....	
179,500	25,000	.0148	.0001	....	....	
186,680	26,000	.0167	....	....	....	
193,860	27,000	.0181	....	....	....	
201,040	28,000	.0214	....	....	....	
208,220	29,000	.0248	....	....	....	Elastic limit.
215,400	30,000	.16	....	....	....	
222,580	31,000	.23	....	....	....	
229,760	32,000	.26	....	....	....	
236,940	33,000	.28	....	....	....	
244,120	34,000	.31	....	....	....	
251,300	35,000	.34	....	....	....	
258,480	36,000	.37	....	....	....	
265,660	37,000	.42	....	....	....	
272,840	38,000	.45	....	....	....	
280,020	39,000	.47	....	....	....	
287,200	40,000	.51	....	....	....	
294,380	41,000	.56	....	....	....	
301,560	42,000	.59	....	....	....	
308,740	43,000	.64	....	....	....	
315,920	44,000	.72	....	....	....	Ultimate strength.

Flanges buckled.

No. 1997.

Rolled H section.

Pin ends.

Length: Of rolled section, 2 feet 5½ inches; of column, C to C of pins, 3 feet 2½ inches.

Weight, 60 pounds.

Sectional area, 7.18 square inches.

Gauged length, 20″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,180	1,000	0.	0.	....	....	Initial load.
35,900	5,000	.0027	....	....	....	
71,800	10,000	.0060	0.	....	....	
107,700	15,000	.0092	....	....	....	
143,600	20,000	.0126	0.	....	....	
179,500	25,000	.0168	.0005	....	....	
186,680	26,000	.0181	....	....	....	
193,860	27,000	.0200	....	....	....	
201,040	28,000	.0223	....	....	....	
208,220	29,000	.0234	....	....	....	Elastic limit.
215,400	30,000	.0900 .13	....	....	....	
222,580	31,000	.18	....	....	....	
229,760	32,000	.23	....	....	....	
244,120	34,000	.30	....	....	....	
258,480	36,000	.35	....	....	....	
272,840	38,000	.42	....	....	....	
287,200	40,000	.47	....	....	....	
315,920	44,000	.63	....	....	....	
323,100	45,000	.69	....	....	....	
330,280	46,000	.84	....	....	....	Ultimate strength.

No. 1992.

Rolled H section.
Pin ends.
Length: Of rolled section, 5 feet 8 inches; of column, C to C of pins, 6 feet 5 inches.
Weight, 138 pounds.
Sectional area, 7.16 square inches.
Initial deflection: Horizontal, ''.08, ''.11; vertical, ''.02.
Gauged length, 50''.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,160	1,000	0.	0.	0.	0.	Initial load.
35,800	5,000	.0059	....	0.	0.	
71,600	10,000	.0142	0.	.01	0.	
....	1,000	....	....	0.	0.	
107,400	15,000	.0222	....	.01	0.	
143,200	20,000	.0305	0.	.01	0.	
....	1,000	....	....	0.	0.	
179,000	25,000	.0418	.0025	.03	.01	
....	1,000	....	....	.03	.01	
186,160	26,000	.0450	....	.04	.01	
193,320	27,000	.0486	....	.06	.01	
200,480	28,000	.0549	....	.09	.01	
206,600	28,850	.0755	....	.17	.03	Ultimate strength.

Column failed by deflecting laterally perpendicular to the plane of the pins.

No. 1993.

Rolled H section.

Pin ends.

Length: Of rolled section, 5 feet 8 inches; of column, C to C of pins, 6 feet 5 inches.

Weight, 138½ pounds.

Sectional area, 7.19 square inches.

Initial deflection: Horizontal, kinky, ″.04±; vertical ″.05.

Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,190	1,000	0.	0.	0.	0.	Initial load.
35,950	5,000	.0093	....	0.	0.	
71,900	10,000	.0187	0.	.01	0.	
....	1,000	....	....	0.	0.	
107,850	15,000	.0266	....	.01	0.	
143,800	20,000	.0348	.0003	.01	0.	
....	1,000	....	....	.01	0.	
179,750	25,000	.0421	.0010	.01	0.	
....	1,000	....		.01	0.	
186,940	26,000	.0437	....	.01	0.	
194,130	27,000	.0468	....	0.	0.	
201,320	28,000	.0526	....	0.	0.	
208,510	29,000	.0689	....	0.	.04	
215,700	30,000	.1225	....	0.	.16	
239,800	33,350	....	....	....	....	Ultimate strength.

Failed by deflecting laterally parallel to the plane of the pins.

No. 1994.

Rolled H section.

Pin ends.

Length: Of rolled section, 5 feet 8 inches; of column, C to C of pins, 6 feet 5 inches.

Weight, 138 pounds.

Sectional area, 7.16 square inches.

Initial deflection: Horizontal, ″.04, ″.03; vertical, ″.03.

Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,160	1,000	0.	0.	0.	0.	Initial load.
35,800	5,000	.0041	....	0.	0.	
71,600	10,000	.0122	0.	0.	.01	
....	1,000	....	....	0.	0.	
107,400	15,000	.0204	....	0.	.01	
143,200	20,000	.0287	.0004	.01	.01	
....	1,000	....	....	0.	0.	
179,000	25,000	.0390	.0006	.01	.01	
....	1,000	....	....	0.	0.	
186,160	26,000	.0412	....	.01	.01	
193,320	27,000	.0442	....	.01	.01	
200,480	28,000	.0471	....	.01	.01	
207,640	29,000	.0500	....	.01	.01	
214,800	30,000	.0630	.0166	.02	.01	
....	1,000	....	....	.01	.01	
220,400	30,780	....	....	....	....	Ultimate strength.

Column failed by deflecting laterally perpendicular to the plane of the pins.

No. 1989.

Rolled H section.
Pin ends.
Length: Of rolled section, 8 feet 10½ inches; of column, C to C of pins, 9 feet 7½ inches.
Weight, 218 pounds.
Sectional area, 7.22 square inches.
Initial deflection: Horizontal, ″.07, ″.04; vertical, ″.07.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,220	1,000	0.	0.	0.	0.	Initial load.
36,100	5,000	.0063	....	0.	0.	
72,200	10,000	.0145	0.	0.	0.	
....	1,000	....	....	0.	0.	
108,300	15,000	.0222	....	.01	0.	
144,400	20,000	.0304	0.	.02	.01	
....	1,000	....	....	0.	0.	
151,620	21,000	.0323	....	.02	.01	
158,840	22,000	.0340	....	.02	.01	
166,060	23,000	.0364	....	.02	.01	
173,280	24,000	.0386	....	.03	.01	
180,500	25,000	.0417	.0015	.04	0.	
....	1,000	....	....	.01	0.	
187,720	26,000	.0440	....	.06	0.	
194,940	27,000	.0469	....	.07	.01	
202,160	28,000	.0557 .0640	....	.19 .29	.04 .05	Ultimate strength.
135,000	....	....	....	1.25	.06	Load and deflections after passing the maximum stress.

Failed by deflection, perpendicular to the axes of the pins. After passing the maximum stress the column yielded rapidly, the deflections increasing as the load fell, but without sudden springing and sudden loss in compression resistance.

No. 1990.

Rolled H section.

Pin ends.

Length: Of rolled section, 8 feet 10½ inches; of column C to C of pins, 9 feet 7½ inches.

Weight, 220 pounds.

Sectional area, 7.29 square inches.

Initial deflection: Horizontal, ″.20, ″.12; vertical, ″.04.

Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,290	1,000	0.	0.	0.	0.	Initial load.
36,450	5,000	.0081	....	.01	.01	
72,900	10,000	.0187	.0008	.02	.04	
....	1,000	....	....	0.	0.	
109,350	15,000	.0267	....	.02	.04	
145,800	20,000	.0357	.0002	.03	.04	
....	1,000	....	....	0.	0.	
182,250	25,000	.0430	.0015	.05	0.	
....	1,000	....	....	.02	0.	
189,540	26,000	.0448	....	.09	0.	
196,830	27,000	.0473	....	.12	.01	
204,120	28,000	.0580	.0039	.26	.02	Ultimate strength.
....	1,000	....	....	.18	.02	

Failed by deflection, perpendicular to the axes of the pins

No. 1991.

Rolled H section.
Pin ends.
Length: Of rolled section, 8 feet 10½ inches; of column, C to C of pins, 9 feet 7½ inches.
Weight, 217 pounds.
Sectional area, 7.19 square inches.
Initial deflection: Horizontal, ″.07, ″.00; vertical, ″.08.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Com- pression.	Set.	Hori- zontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,190	1,000	0.	0.	0.	0.	Initial load.
35,950	5,000	.0055	....	0.	.01	
71,900	10,000	.0136	.0006	.01	.02	
....	1,000	....	....	.01	0.	
107,850	15,000	.0214	....	.01	.02	
143,800	20,000	.0300	.0005	.01	.02	
....	1,000	....	....	.01	0.	
179,750	25,000	.0415	.0014	.01	0.	
....	1,000	....	....	.01	0.	
186,940	26,000	.0042	....	.02	.01	
194,130	27,000	.0478	....	.04	.01	
201,320	28,000	.0521	.0078	.07	.02	
....	1,000	....	....	.06	.02	
206,000	28,650	....	....	.18	.04	Ultimate strength.

Column failed by deflection, perpendicular to the plane of the pins.

No. 1986.

Rolled H section.
Pin ends.
Length: Of rolled section, 12 feet 1 inch; of column, C to C of pins, 12 feet 10 inches.
Weight, 297 pounds.
Sectional area, 7.23 square inches.
Initial deflection: Horizontal, ''.23, ''.18; vertical, ''.03.
Gauged length, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,230	1,000	0.	0.	0.	0.	Initial load.
36,150	5,000	.0184	....	.05	.02	
72,300	10,000	.0355	.0020	.09	.03	
....	1,000	....	....	0.	.02	
108,450	15,000	.0523	....	.10	.03	
144,600	20,000	.0696	.0027	.12	.03	
....	1,000	....	....	.01	.03	
151,830	21,000	.0733	....	.15	.03	
159,060	22,000	.0777	....	.17	.03	
166,290	23,000	.0821	....	.21	.03	
173,520	24,000	.0910	....	....	....	Ultimate strength.

Failed by lateral deflection, perpendicular to axes of pins.

No. 1987.

Rolled H section.
Pin ends.
Length: Of rolled section, 12 feet 1 inch; of column, C to C of pins, 12 feet 10 inches.
Weight, 299 pounds.
Sectional area, 7.28 square inches.
Initial deflection: Horizontal, ''.15; vertical, ''.06.
Gauged length, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,280	1,000	0.	0.	0.	0.	Initial load.
36,400	5,000	.0180	....	.01	0.	
72,800	10,000	.0350	.0018	.03	.01	
....	1,000	....	....	0.	0.	
109,200	15,000	.0519	....	.03	.01	
145,600	20,000	.0692	.0027	.04	.01	
....	1,000	....	....	0.	0.	
152,880	21,000	.0727	....	.05	.01	
160,160	22,000	.0765	....	.05	.01	
167,440	23,000	.0805	....	.07	.01	
174,720	24,000	.0850	....	.08	.01	
182,000	25,000	.0913	.0104	.13	.01	
....	1,000	....	....	.09	0.	
189,280	26,000	....	....	.31	.01	Ultimate strength.
			Load	gradually	fell to	
186,000	when sudden lateral yielding occurred.					
107,000	....	....	....	1.65	.02	Load and deflections after sudden springing.

Column failed by lateral deflection, perpendicular to the axes of the pins.

No. 1988.

Rolled H section.

Pin ends.

Length: Of rolled section, 12 feet 1 inch; of column, C to C of pins, 12 feet 10 inches.

Weight, 298 pounds.

Sectional area, 7.25 square inches.

Initial deflection: Horizontal, ″.07, ″.10; vertical, ″.08.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,250	1,000	0.	0.	0.	0.	Initial load.
36,250	5,000	.0186	....	0.	.02	
72,500	10,000	.0353	.0018	0.	.02	
....	1,000	....	....	0.	.01	
108,750	15,000	.0515	....	0.	.03	
145,000	20,000	.0676	.0021	.01	.03	
....	1,000	....	....	0.	.01	
152,250	21,000	.0707	....	.01	.03	
159,500	22,000	.0730	....	.02	.03	
166,750	23,000	.0760	....	.02	.03	
174,000	24,000	.0791	....	.03	.03	
181,250	25,000	.0831	.0053	.05	.03	
....	1,000	....	....	.04	.01	
188,500	26,000	.0880	....	.08	.03	
195,750	27,000	....	....	.16	.03	Ultimate strength.
92,000	....	....	....	2.18	.03	Load and deflections after sudden springing.

Failed by lateral deflection, perpendicular to the axes of the pins.

No. 1983.

Rolled H section.
Pin ends.
Length: Of rolled section, 15 feet 3½ inches; of column, C to C of pins, 16 feet ½ inch.
Weight, 376½ pounds.
Sectional area, 7.24 square inches.
Initial deflection: Horizontal, ″.10; vertical, ″.08.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,240	1,000	0.	0.	0.	0.	Initial load.
36,200	5,000	.0098	....	0.	.04	
72,400	10,000	.0258	.0006	.01	.04	
....	1,000	....	....	0.	0.	
108,600	15,000	.0418	....	.04	.07	
144,800	20,000	.0582	.0022	.09	.08	
....	1,000	....	....	.03	.03	
152,040	21,000	.0612	....	.15	.09	
159,280	22,000	.0650	.0032	.22	.12	
....	1,000	....	....	.12	.09	
163,200	22,540	....	....	....	....	Ultimate strength.
81,000	....	....	....	2.26	.19	Load and deflections after sudden springing at time of reaching the maximum stress.

No. 1984.

Rolled H section.

Pin ends.

Length: Of rolled section, 15 feet 3½ inches; of column, C to C of pins, 16 feet ½ inch.

Weight, 375 pounds.

Sectional area, 7.21 square inches.

Initial deflection: Horizontal, ″.20, ″.15; vertical, 0″.

Gauged length, 100″.

Counterweighted at the middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,210	1,000	0.	0.	0.	0.	Initial load.
36,050	5,000	.0174	....	.01	.04	
72,100	10,000	.0351	.0005	.07	.05	
....	1,000	....	....	0.	0.	
108,150	15,000	.0516	....	.11	.05	
144,200	20,000	.0685	.0011	.18	.05	
....	1,000	....	....	0.	.01	
151,410	21,000	.0716	....	.21	.05	
158,620	22,000	.0741	....	.23	.05	
172,500	23,925	....	....	....	....	Ultimate strength.
79,000	....	....	....	2.34	1.00	Load and deflections after sudden springing.

Failed by lateral deflection perpendicular to the axes of the pins, taking the direction of the initial deflection.

No. 1985.

Rolled H section.
Pin ends.
Length: Of rolled section, 15 feet 3½ inches; of column, C to C of pins, 16 feet ½ inch.
Weight, 373 pounds.
Sectional area, 7.18 square inches.
Initial deflection: Horizontal, ″.05, ″.06; vertical, ″.25.
Gauged length, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,180	1,000	0.	0.	0.	0.	Initial load.
35,900	5,000	.0128	....	.01	.01	
71,800	10,000	.0300	0.	.01	.01	
....	1,000	....	....	0.	0.	
107,700	15,000	.0477	....	.02	.01	
154,600	20,000	.0647	.0007	.03	.01	
....	1,000	....	....	0.	0.	
150,780	21,000	.0691	....	.03	.01	
157,960	22,000	.0732	....	.05	.01	
165,140	23,000	.0774	....	.07	.02	
172,320	24,000	.0826	....	.09	.03	
179,500	25,000	.0921	.0101	.20	.06	Ultimate strength.
....	1,000	....	....	.11	.03	
70,000	....	....	....	2.61	.07	Load and deflections after sudden springing, which took place soon after passing the maximum stress.

Failed by deflection, perpendicular to the axes of the pins.

No. 1980.

Rolled H sections.

Pin ends.

Length: Of rolled section, 18 feet 6 inches; of column C to C of pins, 19 feet 3 inches.

Weight, 457 pounds.

Sectional area, 7.27 square inches.

Initial deflection: Horizontal, ″.15; vertical, 0.

Gauged length, 100″.

Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
7,270	1,000	0.	0.	0.	0.	Initial load.
36,350	5,000	.0134	....	0.	0.	
72,700	10,000	.0304	.0005	.01	.02	
....	1,000	....	....	0.	0.	
109,050	15,000	.0471	....	.13	.02	
145,400	20,000	.0645	.0014	.25	.02	
....	1,000	....	....	.05	0.	
148,000	20,360	....	....	....	....	Ultimate strength.
		Failed by lateral deflection perpendicular to plane of pins.				
56,500	....	....	....	1.05	0.	Load and deflections after sudden lateral springing, succeeding the maximum load.

No. 1981.

Rolled H section.

Pin ends.

Length: Of rolled section, 18 feet 6 inches; of column C to C of pins, 19 feet 3 inches.

Weight, 455½ pounds.

Sectional area, 7.24 square inches.

Initial deflection: Horizontal, ″.16; vertical, ″.22.

Gauged length, 100″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inches.*	*Inch.*	
7,240	1,000	0.	0.	0.	0.	Initial load.
36,200	5,000	.0148	....	.05	0.	
72,400	10,000	.0327	.0006	.12	.02	
....	1,000	....	....	0.	0.	
108,600	15,000	.0511	.0011	.23	.03	
....	1,000	....	....	.01	0.	
126,200	17,430	....	....	....	....	Ultimate strength.
62,000	....	....	....	2.34	.03	

No. 1982.

Rolled H section.
Pin ends.
Length: Of rolled section, 18 feet 6 inches; of column C to C of pins, 19 feet 3 inches.
Weight, 462 pounds.
Sectional area, 7.35 square inches.
Initial deflection, horizontal, ''.42.
Gauged length, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inches.*	*Inch.*	
7,350	1,000	0.	0.	0.	0.	Initial load.
36,750	5,000	.0140	....	.14	.02	
73,500	10,000	.0329	.0006	.96	.05	
....	1,000	....	....	.03	.00	
74,200	10,100	....	....	1.74	.05	Ultimate strength.
65,000	....	....	....	2.60	.05	Loads and deflections after passing the maximum stress.
55,000	....	....	....	3.84	.05	
45,000	....	....	....	5.10	....	

Failed by lateral deflection perpendicular to plane of pins following the initial direction of the bend in the column.

TABULATION OF COMPRESSION TESTS OF ROLLED H SECTIONS, STEEL.

PIN ENDS.

Number of test.	Lengths.			Sectional area.	Ultimate strength.	
	Feet.	Inches.	$\frac{l}{r}$		Total.	Per square inch.
				Sq. in.	*Pounds.*	*Pounds.*
1995	3	2½	25	7.30	328,500	45,000
1996	3	2½	25	7.18	315,920	44,000
1997	3	2½	25	7.18	330,280	46,000
1992	6	5	50	7.16	206,600	28,850
1993	6	5	50	7.19	239,800	33,350
1994	6	5	50	7.16	220,400	30,780
1989	9	7½	75	7.22	202,160	28,000
1990	9	7½	75	7.29	204,120	28,000
1991	9	7½	75	7.19	206,000	28,650
1986	12	10	100	7.23	173,520	24,000
1987	12	10	100	7.28	189,280	26,000
1988	12	10	100	7.25	195,750	27,000
1983	16	½	125	7.24	163,200	22,540
1984	16	½	125	7.21	172,500	23,925
1985	16	½	125	7.18	179,500	25,000
1980	19	3	150	7.27	148,000	20,360
1981	19	3	150	7.24	126,200	17,430
1982	19	3	150	7.35	74,200	10,100

BUILT I SECTIONS, STEEL.

BUILT I SECTIONS, STEEL.

COMPRESSION TESTS.

Built sections made up of web plate, 10″ by ⅜″; four angles, 4″ by 3″ by ⅜″; ¾″ rivets, 3″ pitch at ends of columns; 6″ pitch along middle of lengths.

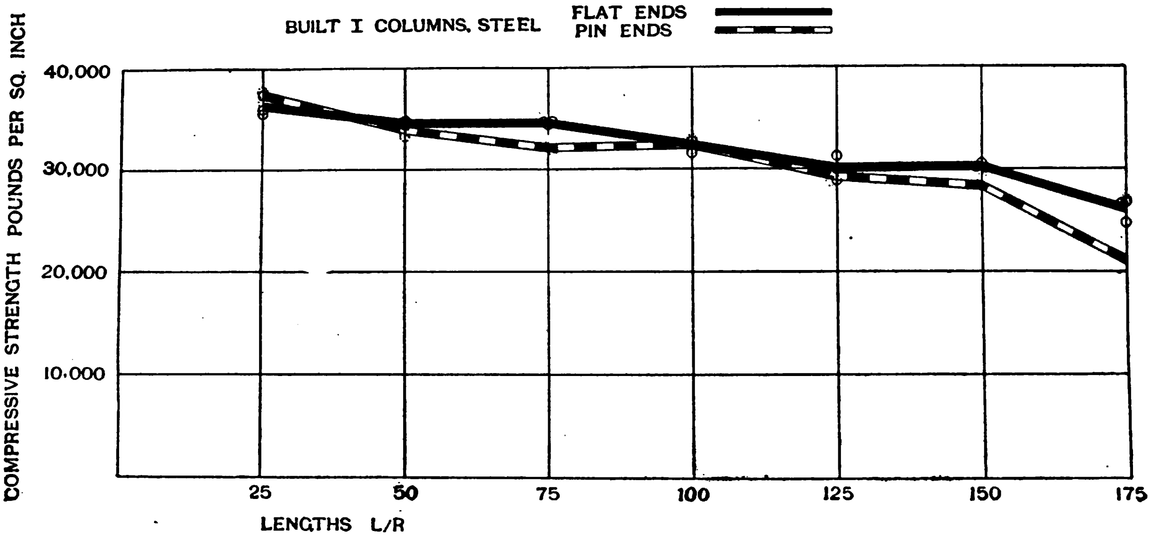
Nominal weight of built section, 46.7 pounds per foot.

Nominal sectional area, 13.71 square inches.

Least radius of gyration, 1″.65.

SCHEDULE OF LENGTHS.

3 feet 5¼ inches.......	25 l/r
6 feet 10½ inches......	50 l/r
10 feet 3¾ inches......	75 l/r
13 feet 9 inches.......	100 l/r
17 feet 2¼ inches......	125 l/r
20 feet 7½ inches......	150 l/r
24 feet................	175 l/r



BUILT I SECTIONS, STEEL.

CURVES OF COMPRESSIVE STRENGTH, FLAT AND PIN ENDS.

BUILT I COLUMNS, STEEL.

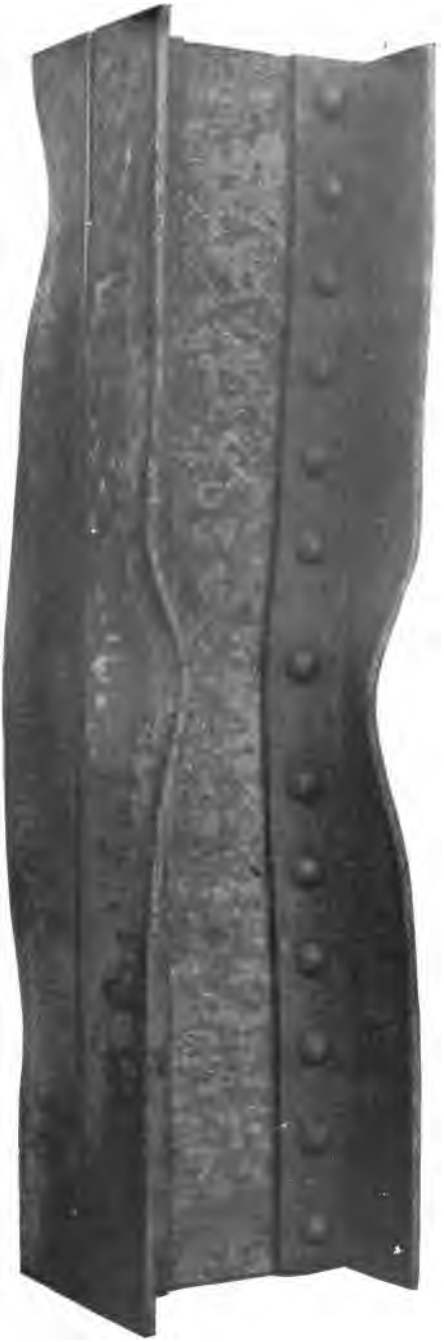
FLAT ENDS.

No. 2015.

Built I column.
Flat ends.
Length, 3 feet 5¼ inches.
Weight, 168½ pounds.
Sectional area, 13.81 square inches.
Gauged length, taken on edge of web plate, 20″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,810	1,000	0.	0.	....	....	Initial load.
69,050	5,000	.0024	.0002	....	....	
138,100	10,000	.0056	.0002	....	....	
207,150	15,000	.0089	.0003	....	....	
276,200	20,000	.0128	.0007	....	....	
345,250	25,000	.0170	.0016	....	....	
359,060	26,000	.0183	....	....	....	
372,870	27,000	.0188	....	....	....	
386,680	28,000	.0205	.0029	....	....	
400,490	29,000	.0219	....	....	....	
414,300	30,000	.0232	.0050	....	....	
428,110	31,000	.0262	....	....	....	Rested under initial load 16 hours.
441,920	32,000	.0283	....	....	....	Elastic limit.
455,730	33,000	.0339	.0128	....	....	
469,540	34,000	.0485	....	....	....	
483,350	35,000	.1230	.1029	....	....	
497,160	36,000	.13	....	....	....	
510,970	37,000	.16	....	....	....	
517,200	37,450	....	....	....	....	Ultimate strength.

Failed by buckling the flanges.



NO. 2017.

APPEARANCE OF COLUMN AFTER TESTING.

No. 2018.

Built I column.
Flat ends.
Length, 6 feet 10½ inches.
Weight, 333½ pounds.
Sectional area, 13.78 square inches.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,780	1,000	0.	0.	....	....	Initial load.
68,900	5,000	.0060	0.	....	....	
137,800	10,000	.0148	0.	....	....	
206,700	15,000	.0237	.0001	....	....	
275,600	20,000	.0324	.0003	....	....	
344,500	25,000	.0420	.0012	....	....	
358,280	26,000	.0444	....	....	....	
372,060	27,000	.0464	....	....	....	
385,840	28,000	.0491	.0029	....	....	
399,620	29,000	.0514	....	....	....	
413,400	30,000	.0544	.0050	....	....	
427,180	31,000	.0576	....	....	....	Elastic limit.
440,960	32,000	.0621	....	....	....	
454,740	33,000	.0735	.0169	....	....	
468,520	34,000	.0983	....	....	....	
474,800	34,460	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to plane of web, and buckling of the flanges.

No. 2019.

Built **I** column.
Flat ends.
Length, 6 feet 10½ inches.
Weight, 334 pounds.
Sectional area, 13.80 square inches.
Gauged length, taken on edge of web plate, 50 ″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,800	1,000	0.	0.			Initial load.
69,000	5,000	.0064	.0002			
138,000	10,000	.0150	.0004			
207,000	15,000	.0237	.0005			
276,000	20,000	.0326	.0009			
345,000	25,000	.0425	.0021			
358,800	26,000	.0447				
372,600	27,000	.0472				
386,400	28,000	.0496	.0038			
400,200	29,000	.0524				
414,000	30,000	.0554	.0061			
427,800	31,000	.0588				
441,600	32,000	.0630				Elastic limit.
455,400	33,000	.0690	.0153			
469,200	34,000	.0910	.0356			
476,900	34,560					Ultimate strength.

Failed by triple flexure, perpendicular to plane of web, and buckling of the flanges.

No. 2020.

Built I column.
Flat ends.
Length, 6 feet 10½ inches.
Weight, 335 pounds.
Sectional area, 13.84 square inches.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,840	1,000	0.	0.	....	....	Initial load.
69,200	5,000	.0061	0.	....	....	
138,400	10,000	.0138	0.	....	....	
207,600	15,000	.0219	0.	....	....	
276,800	20,000	.0308	0.	....	....	
346,000	25,000	.0409	.0014	....	....	
359,840	26,000	.0431	....	....	....	
373,680	27,000	.0452	....	....	....	
387,520	28,000	.0478	.0031	....	....	
401,360	29,000	.0506	....	....	....	
415,200	30,000	.0540	.0060	....	....	
429,040	31,000	.0571	....	....	....	Elastic limit.
442,880	32,000	.0628	....	....	....	
456,720	33,000	.0688	.0160	....	....	
470,560	34,000	.0834	.0304	....	....	
480,900	34,750	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of web, and buckling of the flanges.

No. 2021.

Built I column.
Flat ends.
Length, 10 feet 3¾ inches.
Weight, 499½ pounds.
Sectional area, 13.81 square inches.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,810	1,000	0.	0.	....	....	
69,050	5,000	.0062	0.	....	....	
138,100	10,000	.0147	0.	....	....	
207,150	15,000	.0234	0.	....	....	
276,200	20,000	.0322	0.	....	....	
345,250	25,000	.0414	.0007	....	....	
359,060	26,000	.0433	....	....	....	
372,870	27,000	.0454	....	....	....	
386,680	28,000	.0474	.0016	....	....	
400,490	29,000	.0489	....	....	....	
414,300	30,000	.0514	.0024	....	....	
428,110	31,000	.0537	....	....	....	
441,920	32,000	.0569	....	....	....	
455,730	33,000	.0600	.0063	....	....	Elastic limit.
469,540	34,000	.0644	....	....	....	
479,100	34,690	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web.

No. 2022.

Built **I** column.
Flat ends.
Length, 10 feet 3¾ inches.
Weight, 503 pounds.
Sectional area, 13.91 square inches.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,910	1,000	0.	0.	....	....	Initial load.
69,550	5,000	.0067	0.	....	....	
139,100	10,000	.0151	0.	....	....	
208,650	15,000	.0238	.0003	....	....	
278,200	20,000	.0324	.0003	....	....	
347,750	25,000	.0414	.0009	....	....	
361,660	26,000	.0432	....	....	....	
375,570	27,000	.0451	....	....	....	
389,480	28,000	.0471	.0013	....	....	
403,390	29,000	.0492	....	....	....	
417,300	30,000	.0514	.0020	....	....	
431,210	31,000	.0534	....	....	....	
445,120	32,000	.0561	....	....	....	
459,030	33,000	.0594	.0050	....	....	Elastic limit.
472,940	34,000	.0644	.0089..	....	....	
483,200	34,740	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web.

No. 2023.

Built I column.
Flat ends.
Length, 10 feet 3¾ inches.
Weight, 497 pounds.
Sectional area, 13.74 square inches.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,740	1,000	0.	0.	....	....	Initial load.
68,700	5,000	.0061	0.	....	....	
137,400	10,000	.0149	0.	....	....	
206,100	15,000	.0235	.0004	....	....	
274,800	20,000	.0324	.0005	....	....	
343,500	25,000	.0414	.0011	....	....	
357,240	26,000	.0434	....	....	....	
370,980	27,000	.0454	....	....	....	
384,720	28,000	.0475	.0020	....	....	
398,460	29,000	.0500	....	....	....	
412,200	30,000	.0524	.0030	....	....	
425,940	31,000	.0549	....	....	....	
439,680	32,000	.0578	....	....	....	
453,420	33,000	.0614	.0064	....	....	Elastic limit.
467,160	34,000	.0674	.0110	....	....	
472,900	34,420	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web.

No. 2024.

Built I column.
Flat ends.
Length, 13 feet 8¾ inches.
Weight, 660½ pounds.
Sectional area, 13.76 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,760	1,000	0.	0.	0.	0.	Initial load.
68,800	5,000	.0130	....	.03	0.	
....	1,000	....	.0010	0.	0.	
137,600	10,000	.0302	....	.03	0.	
....	1,000	....	.0010	0.	0.	
206,400	15,000	.0476	....	.03	.01	
....	1,000	....	.0012	0.	.01	
275,200	20,000	.0653	....	.03	.01	
....	....	....	.0021	0.	.01	
344,000	25,000	.0740	....	.05	.01	
....	1,000	....	.0043	0.	.01	
357,760	26,000	.0882	....	.05	.01	
371,520	27,000	.0925	....	.05	.01	
385,280	28,000	.0961	....	.03	.03	
....	1,000	....	.0068	0.	.01	
399,040	29,000	.1009	....	.02	.03	
412,800	30,000	.1058	....	.08	.03	
....	1,000	.0105	....	.08	.03	
435,800	31,670	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web. After passing the maximum stress there was a gradual increase in deflection, with gradual decrease in load.

No. 2025.

Built **I** column.
Flat ends.
Length, 13 feet 8¾ inches.
Weight, 663 pounds.
Sectional area, 13.81 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,810	1,000	0.	0.	0.	0.	Initial load.
69,050	5,000	.0131	....	0.	0.	
....	1,000	....	0.	0.	0.	
138,100	10,000	.0294	....	0.	.01	
....	1,000	....	- .0005	0.	0.	
207,150	15,000	.0461	....	0.	.02	
....	1,000	....	— .0006	0.	.01	
276,200	20,000	.0637	....	.04	.02	
....	1,000	....	— .0003	.02	.01	
345,250	25,000	.0811	....	.04	.02	
....	1,000	....	+ .0001	.02	.01	
359,060	26,000	.0855	....	.04	.02	
372,870	27,000	.0896	....	.04	.02	
386,680	28,000	.0944	....	.04	.02	
....	1,000	....	.0025	.02	.01	
400,490	29,000	.0980	....	.04	.02	
414,300	30,000	.1035	....	.06	.02	
....	1,000	....	.0055	.04	.01	
428,110	31,000	.1102	....	.10	.02	
....	1,000	....	.0102	.06	.01	
452,900	32,800	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web.

No. 2026.

Built I column.
Flat ends.
Length, 13 feet 8¾ inches.
Weight, 660½ pounds.
Sectional area, 13.76 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,760	1,000	0.	0.	0.	0.	Initial load.
68,800	5,000	.0132	....	0.	.02	
....	1,000	....	0.	0.	.01	
137,600	10,000	.0300	....	.02	.02	
....	1,000	....	− .0002	0.	.02	
206,400	15,000	.0470	....	.04	.02	
....	1,000	....	− .0002	.02	.02	
275,200	20,000	.0647	....	.04	.02	
....	1,000	....	+ .0002	.02	.02	
344,000	25,000	.0834	....	.02	.02	
....	1,000	....	.0023	.02	.02	
357,760	26,000	.0879	....	.02	.02	
371,520	27,000	.0921	....	0.	.02	
385,280	28,000	.0969	....	0.	.02	
....	1,000	....	.0042	0.	.02	
399,040	29,000	.1007	....	.02	.02	
412,800	30,000	.1059	....	.02	.02	
....	1,000	....	.0069	.02	.02	
426,560	31,000	.1122	....	.04	0.	
....	1,000	....	.0098	.02	.01	
451,300	32,800	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web.

No. 2027.

Built **I** column.
Flat ends.
Length, 17 feet 2 inches.
Weight, 831½ pounds.
Sectional area, 13.87 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,870	1,000	0.	0.	0.	0.	Initial load.
69,350	5,000	.0125	....	.02	.01	
....	1,000	....	− .0002	0.	0.	
138,700	10,000	.0291	....	.04	.01	
....	....	....	− .0004	0.	0.	
208,050	15,000	.0462	....	.05	.01	
....	1,000	....	− .0003	0.	0.	
277,400	20,000	.0639	....	.05	.02	
....	1,000	....	+ .0003	0.	.01	
346,750	25,000	.0832	....	.05	.03	
....	1,000	....	.0029	0.	.01	
360,620	26,000	.0877	....	.05	.03	
374,490	27,000	.0924	....	.05	.03	
388,360	28,000	.0973	....	.05	.03	
....	1,000	....	.0065	0.	.01	
402,230	29,000	.1031	....	.03	.03	
415,100	29,930	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web. Sudden springing sidewise occurred when maximum load was reached.

No. 2028.

Built I column.
Flat ends.
Length, 17 feet 2 inches.
Weight, 838 pounds.
Sectional area, 13.98 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,980	1,000	0.	0.	0.	0.	Initial load.
69,900	5,000	.0131	....	0.	0.	
....	1,000	....	− .0002	0.	0.	
139,800	10,000	.0300	....	0.	.01	
....	1,000	....	− .0004	0.	0.	
209,700	15,000	.0472	....	0.	.01	
....	1,000	....	− .0003	0.	0.	
279,600	20,000	.0651	....	.03	.01	
....	1,000	....	+ .0006	0.	0.	
349,500	25,000	.0847	....	.05	.01	
....	1,000	....	.0033	0.	0.	
363,480	26,000	.0890	....	.06	.01	
377,460	27,000	.0934	....	.09	.02	
391,440	28,000	.0982	....	.12	.02	
....	1,000	....	.0062	.06	.01	
405,420	29,000	....	....	....	....	
437,600	31,300	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web. Sudden springing sidewise occurred when maximum load was reached.

No. 2029.

Built I column.
Flat ends.
Length, 17 feet 2 inches.
Weight, 837 pounds.
Sectional area, 13.96 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,960	1,000	0.	0.	0.	0.	Initial load.
69,800	5,000	.0134	....	0.	0.	
....	1,000	....	0.	0.	0.	
139,600	10,000	.0306	....	0.	0.	
....	1,000	....	0.	0.	0.	
209,400	15,000	.0480	....	0.	0.	
....	1,000	....	.0005	0.	0.	
279,200	20,000	.0665	....	0.	0.	
....	1,000	....	.0018	0.	0.	
349,000	25,000	.0861	....	.02	0.	
....	1,000	....	.0050	.02	0.	
362,960	26,000	.0909	....	.02	0.	
376,920	27,000	.0957	....	.04	0.	
390,880	28,000	.1006	....	.10	0.	
....	1,000	....	.0099	.07	0.	
404,100	28,880	....	....	....	....	Ultimate strength.

Failed by triple flexure, perpendicular to the plane of the web. Sudden springing sidewise occurred when maximum load was reached.

o. 2014.

veb plate, 100″.

Remarks

Initial load

strength.

of column after end
ging laterally

occurred when
perpendicular

n
r

No. 2030.

Built I column.
Flat ends.
Length, 20 feet 7¼ inches.
Weight, 1,015 pounds.
Sectional area, 14.12 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
14,120	1,000	0.	0.	0.	0.	Initial load.
70,600	5,000	.0134	....	.02	0.	
....	1,000	....	−.0002	0.	0.	
141,200	10,000	.0302	....	.04	0.	
....	1,000	....	−.0003	0.	0.	
211,800	15,000	.0476	....	.04	0.	
....	1,000	....	−.0002	0.	0.	
282,400	20,000	.0631	....	.05	0.	
....	1,000	....	+.0003	0.	0.	
353,000	25,000	.0844	....	0.	0.	
....	1,000	....	.0024	0.	0.	
367,120	26,000	.0889	....	0.	0.	
381,240	27,000	.0935	....	0.	.02	
395,360	28,000	.0982	....	.01	.02	
....	1,000	....	.0057	.01	.02	
409,480	29,000	.1035	....	0.	.02	
....	1,000	....	.0076	0.	.02	
423,600	30,000	....	....	....	....	
424,800	30,080	....	....	....	....	Ultimate strength.

Failed by triple flexure. Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2031.

Built I column.
Flat ends.
Length, 20 feet 7¼ inches.
Weight, 1,004 pounds.
Sectional area, 13.96 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,960	1,000	0.	0.	0.	0.	Initial load.
69,800	5,000	.0133	....	.02	0.	
....	1,000	....	0.	0.	0.	
139,600	10,000	.0303	....	.04	0.	
....	1,000	....	.0004	0.	0.	
209,400	15,000	.0479	....	.05	0.	
....	1,000	....	.0005	0.	0.	
279,200	20,000	.0656	....	.06	0.	
....	1,000	....	.0012	0.	0.	
349,000	25,000	.0845	....	.08	0.	
....	1,000	....	.0034	.02	0.	
362,960	26,000	.0890	....	.10	0.	
376,920	27,000	.0934	....	.10	0.	
390,880	28,000	.1002	....	.11	0.	
....	1,000	....	.0070	.04	0.	
404,840	29,000	.1030	....	.14	0.	
....	1,000	....	.0080	.04	0.	
426,100	30,520	....	....	....	....	Ultimate strength.
155,000	....	....	....	....	....	Resistance of column after sudden springing laterally.

Failed by triple flexure. Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2032.

Built I column.
Flat ends.
Length, 24 feet ½ inch.
Weight, 1,174 pounds.
Sectional area, 14 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
14,000	1,000	0.	0.	0.	0.	Initial load.
70,000	5,000	.0134	....	0.	0.	
....	1,000	....	−.0002	0.	0.	
140,000	10,000	.0306	....	.03	0.	
....	1,000	....	0.	0.	0.	
210,000	15,000	.0483	....	.08	0.	
....	1,000	....	.0001	0.	0.	
280,000	20,000	.0665	....	.16	0.	
....	1,000	....	.0010	0.	0.	
346,200	24,730	....	....	....	....	Ultimate strength.
148,800	....	....	....	....	....	Resistance of column after sudden springing laterally.

Failed by triple flexure. Sudden springing sidewise occurred when miximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2033.

Built I column.
Flat ends.
Length, 24 feet ½ inch.
Weight, 1,144 pounds.
Sectional area, 13.63 square inches.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,630	1,000	0.	0.	0.	0.	Initial load.
68,150	5,000	.0132	....	.01	0.	
....	1,000	....	0.	0.	0.	
136,300	10,000	.0302	....	.01	0.	
....	1,000	....	0.	0.	0.	
204,450	15,000	.0469	....	.01	0.	
....	1,000	....	0.	0.	0.	
272,600	20,000	.0645	....	.01	0.	
....	1,000	....	.0005	0.	0.	
286,230	21,000	.0680	....	.01	0.	
299,860	22,000	.0720	....	.02	0.	
....	1,000	....	.0010	0.	0.	
313,490	23,000	.0755	....	.04	0.	
....	1,000	....	.0014	0.	0.	
327,120	24,000	.0794	....	.06	0.	
....	1,000	....	.0020	0.	0.	
340,750	25,000	.0835	....	.08	0.	
....	1,000	....	.0026	0.	0.	
354,380	26,000	....	....	.20	....	
363,200	26,650	....	....	....	....	Ultimate strength.
130,500	....	....	....	....	....	Resistance of column after sudden springing laterally.

Failed by triple flexure. Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2034.

Built I column.
Flat ends.
Length, 24 feet ½ inch.
Weight, 1,143 pounds.
Sectional area, 13.61 square inches.
Initial deflection: Horizontal, ″.10; vertical, ″.12.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,610	1,000	0.	0.	0.	0.	Initial load.
68,050	5,000	.0131	....	0.	0.	
....	1,000	....	0.	0.	0.	
136,100	10,000	.0297	....	0.2	0.	
....	1,000	....	−.0001	0.	0.	
204,150	15,000	.0462	....	.06	0.	
....	1,000	....	−.0001	0.	0.	
272,200	20,000	.0629	....	.07	0.	
....	1,000	....	0.	0.	0.	
285,810	21,000	.0662	....	.08	0.	
299,420	22,000	.0700	....	.09	0.	
....	1,000	....	0.	.	0.	
313,030	23,000	.0730	....	.10	0.	
326,640	24,000	.0754	....	.15	0.	
340,250	25,000	.0805	....	.20	0.	
....	1,000	....	0.0007	.04	0.	
363,700	26,720	....	....	....	....	Ultimate strength.
130,000	....	....	....	....	....	Resistance of column after sudden springing laterally.

Failed by triple flexure. Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

TABULATION OF COMPRESSION TESTS OF BUILT I COLUMNS, STEEL.

FLAT ENDS.

No. of test.	Length.			Sectional area.	Ultimate strength.	
	Feet.	Inches.	$\frac{l}{r}$		Total.	Per square inch.
				Sq. in.	*Pounds.*	*Pounds.*
2015	3	5¼	25	13.81	517,200	37,450
2016	3	5¼	25	13.85	498,600	36,000
2017	3	5¼	25	13.81	491,400	35,580
2018	6	10½	50	13.78	474,800	34,460
2019	6	10½	50	13.80	476,900	34,560
2020	6	10½	50	13.84	480,900	34,750
2021	10	3¾	75	13.81	479,100	34,690
2022	10	3¾	75	13.91	483,200	34,740
2023	10	3¾	75	13.74	472,900	34,420
2024	13	8¾	100	13.76	435,800	31,670
2025	13	8¾	100	13.81	452,900	32,800
2026	13	8¾	100	13.76	451,300	32,800
2027	17	2	125	13.87	415,100	29,930
2028	17	2	125	13.98	437,600	31,300
2029	17	2	125	13.96	404,100	28,880
2014	20	7½	150	14.07	426,000	30,300
2030	20	7¼	150	14.12	424,800	30,080
2031	20	7¼	150	13.96	426,100	30,520
2032	24	0½	175	14.00	346,200	24,730
2033	24	0½	175	13.63	363,200	26,650
2034	24	0½	175	13.61	363,700	26,720

BUILT I COLUMNS, STEEL.

PIN ENDS.

No. 2053.

Built I column.
Pin ends.
Length of column, 2 feet 8¼ inches.
Length from center to center of pins, 3 feet 5¼ inches.
Weight, 131 pounds.
Sectional area, 13.74 square inches.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, taken on edge of web plate, 20″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,740	1,000	0.	0.	....	....	Initial load.
68,700	5,000	.0031	.0001	....	....	
137,400	10,000	.0066	.0002	....	....	
206,100	15,000	.0100	.0003	....	....	
274,800	20,000	.0136	.0006	....	....	
343,500	25,000	.0179	.0013	....	....	
357,240	26,000	.0186	....	....	....	
370,980	27,000	.0197	....	....	....	
384,720	28,000	.0208	.0021	....	....	
398,460	29,000	.0220	....	....	....	
412,200	30,000	.0231	.0033	....	....	
425,940	31,000	.0245	....	....	....	
439,680	32,000	.0265	.0050	....	....	Elastic limit.
453,420	33,000	.0295	.0074	....	....	
467,160	34,000	.0329	.0105	....	....	
517,600	37,670	....	....	....	....	Ultimate strength.

Failed by buckling the flanges and deflecting slightly sidewise.

No. 2054.

Built I column.
Pin ends.
Length of column, 2 feet 8¼ inches.
Length from center to center of pins, 3 feet 5¼ inches.
Weight, 131 pounds.
Sectional area, 13.74 square inches.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, taken on edge of web plate 20″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,740	1,000	0.	0.	....	....	Initial load.
68,700	5,000	.0024	0.	....	....	
137,400	10,000	.0055	.0003	....	....	
206,100	15,000	.0091	.0004	....	....	
274,800	20,000	.0125	.0006	....	....	
343,500	25,000	.0166	.0007	....	....	
357,240	26,000	.0174	....	....	....	
370,980	27,000	.0182	....	....	....	
384,720	28,000	.0192	.0012	....	....	
398,460	29,000	.0202	....	....	....	
412,200	30,000	.0212	.0017	....	....	
425,940	31,000	.0224	....	....	....	
439,680	32,000	.0241	.0029	....	....	
453,420	33,000	.0260	....	....	....	
467,160	34,000	.0297	.0072	....	....	Elastic limit.
480,900	35,000	.0381	.0161	....	....	
494,640	36,000	.07	....	....	....	
508,380	37,000	.17	....	....	....	
520,300	37,870	....	....	....	....	Ultimate strength.

Failed by buckling the flanges.

No. 2055.

Built I column.
Pin ends.
Length of column, 2 feet 8¼ inches.
Length from center to center of pins, 3 feet 5¼ inches.
Weight, 132 pounds.
Sectional area, 13.86 square inches.
Initial deflection; Horizontal, 0″; vertical, 0″.
Gauged length, taken on edge of web plate, 20″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,860	1,000	0.	0.	....	....	Initial load.
69,300	5,000	.0016	0.	....	....	
138,600	10,000	.0044	0.	....	....	
207,900	15,000	.0077	0.	....	....	
277,200	20,000	.0112	0.	....	....	
346,500	25,000	.0150	.0002	....	....	
360,360	26,000	.0160	....	....	....	
374,220	27,000	.0170	....	....	....	
388,080	28,000	.0180	.0008	....	....	
401,940	29,000	.0190	....	....	....	
415,800	30,000	.0204	.0016	....	....	
429,660	31,000	.0220	....	....	....	
443,520	32,000	.0238	.0030	....	....	
457,380	33,000	.0260	....	....	....	Elastic limit.
471,240	34,000	.0298	.0074	....	....	
485,100	35,000	.0370	.0147	....	....	
498,960	36,000	.10	....	....	....	
509,000	36,720	....	....	....	....	Ultimate strength.

Failed by buckling the flanges.

No. 2050.

Built I column.
Pin ends.
Length of column, 6 feet 1½ inches.
Length from center to center of pins, 6 feet 10½ inches.
Weight, 299½ pounds.
Sectional area, 13.89 square inches.
Initial deflection: Horizontal ″.03; vertical 0″.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,890	1,000	0.	0.	....	....	Initial load.
69,450	5,000	.0047	0.	....	....	
138,900	10,000	.0126	0.	....	....	
208,350	15,000	.0214	0.	....	....	
277,800	20,000	.0303	.0004	....	....	
347,250	25,000	.0402	.0016	....	....	
361,140	26,000	.0424	....	....	....	
375,030	27,000	.0448	....	....	....	
388,920	28,000	.0473	.0031	....	....	
402,810	29,000	.0500	....	....	....	
416,700	30,000	.0532	.0048	....	....	
430,590	31,000	.0570	....	....	....	Elastic limit.
444,480	32,000	.0629	.0105	....	....	
467,200	33,640	....	....	....	....	Ultimate strength.

Failed by triple flexure and buckling of the flanges.

No. 2051.

Built I column.
Pin ends.
Length of column, 6 feet 1½ inches.
Length from center to center of pins, 6 feet 10½ inches.
Weight, 300 pounds.
Sectional area, 13.91 square inches.
Initial deflection: Horizontal 0″; vertical 0″.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,910	1,000	0.	0.	....	....	Initial load.
69,550	5,000	.0076	0.	....	....	
139,100	10,000	.0163	0.	....	....	
208,650	15,000	.0250	.0005	....	....	
278,200	20,000	.0341	.0012	....	....	
347,750	25,000	.0443	.0028	....	....	
361,660	26,000	.0465	....	....	....	
375,570	27,000	.0490	....	....	....	
389,480	28,000	.0514	.0046	....	....	
403,390	29,000	.0542	....	....	....	
417,300	30,000	.0572	.0074	....	....	Elastic limit.
431,210	31,000	.0616	....	....	....	
445,120	32,000	.0692	.0170	....	....	
459,030	33,000	.0830	.0297	....	....	
474,100	34,080	....	....	....	....	Ultimate strength.

Failed by triple flexure and buckling of the flanges.

No. 2052.

Built I column.
Pin ends.
Length of column, 6 feet 1½ inches.
Length from center to center of pins, 6 feet 10½ inches.
Weight, 300½ pounds.
Sectional area, 13.93 square inches.
Initial deflection: Horizontal, ″.02; vertical, 0″.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,930	1,000	0.	0.			Initial load.
69,650	5,000	.0058	0.			
139,300	10,000	.0140	0.			
208,950	15,000	.0227	.0001			
278,600	20,000	.0315	.0018			
348,250	25,000	.0419	.0024			
362,180	26,000	.0449				
376,110	27,000	.0464				
390,040	28,000	.0488	.0040			
403,970	29,000	.0514				
417,900	30,000	.0546	.0063			
431,830	31,000	.0581				Elastic limit.
445,760	32,000	.0642				
459,690	33,000	.0770	.0260			
470,900	33,800					Ultimate strength.

Failed by triple flexure and buckling of the flanges.

No. 2047.

Built I column.
Pin ends.
Length of column, 9 feet 6¾ inches.
Length from center to center of pins, 10 feet 3¾ inches.
Weight, 461½ pounds.
Sectional area, 13.76 square inches.
Initial deflection: Horizontal, 0″; vertical, ″.05.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,760	1,000	0.	0.	....	....	Initial load.
68,800	5,000	.0063	0.	....	....	
137,600	10,000	.0146	0.	....	....	
206,400	15,000	.0235	.0005	....	....	
275,200	20,000	.0326	.0012	....	....	
344,000	25,000	.0427	.0030	....	....	
357,760	26,000	.0450	....	....	....	
371,520	27,000	.0471	....	....	....	
385,280	28,000	.0498	.0048	....	....	
399,040	29,000	.0532	....	....	....	
412,800	30,000	.0573	.0084	....	....	Elastic limit.
426,560	31,000	.0618	....	....	....	
440,320	32,000	.0702	.0200	....	....	
444,100	32,270	....	....	....	....	Ultimate strength.

Failed by flexure, perpendicular to the plane of the web.

No. 2048.

Built I column.
Pin ends.
Length of column, 9 feet 6¾ inches.
Length from center to center of pins, 10 feet 3¾ inches.
Weight, 456½ pounds.
Sectional area, 13.61 square inches.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,610	1,000	0.	0.	....	....	Initial load.
68,050	5,000	.0059	0.	....	....	
136,100	10,000	.0143	0.	....	....	
204,150	15,000	.0230	0.	....	....	
272,200	20,000	.0320	.0005	....	....	
340,250	25,000	.0421	.0024	....	....	
353,860	26,000	.0447	....	....	....	
367,470	27,000	.0474	....	....	....	
381,080	28,000	.0502	.0049	....	....	
394,690	29,000	.0533	....	....	....	
408,300	30,000	.0569	.0079	....	....	Elastic limit.
421,910	31,000	.0629	....	....	....	
435,520	32,000	.0880	.0419	....	....	
435,500	32,000	....	....	....	....	Ultimate strength.

Gradual yielding occurred when the stress reached 32,000 pounds per square inch, permitting the load being reduced and the permanent set observed. After this the load was again advanced to the maximum, failure then occurring by flexure. The column deflected in a direction perpendicular to the plane of the web.

No. 2049.

Built I column.
Pin ends.
Length of column, 9 feet 6¾ inches.
Length from center to center of pins, 10 feet 3¾ inches.
Weight, 465 pounds.
Sectional area, 13.87 square inches.
Initial deflection: Horizontal, ″.08; vertical, 0″.
Gauged length, taken on edge of web plate, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,870	1,000	0.	0.	....	....	Initial load.
69,350	5,000	.0064	0.	....	....	
138,700	10,000	.0152	.0001	....	....	
208,050	15,000	.0242	.0005	....	....	
277,400	20,000	.0332	.0013	....	....	
346,750	25,000	.0421	.0027	....	....	
360,620	26,000	.0455		....	....	
374,490	27,000	.0479	....	....	....	
388,360	28,000	.0501	.0044	....	....	
402,230	29,000	.0530	....	....	....	
416,100	30,000	.0556	.0065	....	....	
429,970	31,000	.0585	.0080	....	....	
445,400	32,110	....	....	....	....	Ultimate strength.

Failed by flexure, deflecting perpendicular to the plane of the web.

No. 2044.

Built **I** column.
Pin ends.
Length of column, 13 feet.
Length from center to center of pins, 13 feet 9 inches.
Weight, 616½ pounds.
Sectional area, 13.54 square inches.
Initial deflection: Horizontal, ''.04; vertical, ''.05.
Lower flange bent locally.
Gauged length, taken on edge of web plate, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.*	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,540	1,000	0.	0.	0.	0.	Initial load.
67,700	5,000	.0124	....	0.	0.	
....	1,000	....	.0001	0.	0.	
135,400	10,000	.0289	....	0.	0.	
....	1,000	....	.0001	0.	0.	
203,100	15,000	.0453	....	.02	0.	
....	1,000	....	.0001	0.	0.	
270,800	20,000	.0622	....	.02	0.	
....	1,000	....	.0004	0.	0.	
338,500	25,000	.0805	....	.03	0.	
....	1,000	....	.0019	0.	0.	
352,040	26,000	.0844	....	.04	0.	
365,580	27,000	.0886	....	.04	0.	
379,120	28,000	.0929	....	.05	0.	
....	1,000	....	.0035	0.	0.	
392,660	29,000	.0975	....	.06	0.	
406,200	30,000	.1023	....	.07	0.	
....	1,000	....	.0061	.02	0.	
432,500	31,940	....	....	....	....	Ultimate strength.

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2045.

Built I column.
Pin ends.
Length of column, 12 feet 11¾ inches.
Length from center to center of pins, 13 feet 8¾ inches.
Weight, 613 pounds.
Sectional area, 13.48 square inches.
Initial deflection: Horizontal, ″.08; vertical, ″.10.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,480	1,000	0.	0.	0.	0.	Initial load.
67,400	5,000	.0180	....	0.	.03	
....	1,000	....	.0001	0.	0.	
134,800	10,000	.0365	....	0.	.04	
....	1,000	....	.0002	0.	0.	
202,200	15,000	.0534	....	0.	.04	
....	1,000	....	.0004	0.	0.	
269,600	20,000	.0705	....	.02	.04	
....	1,000	....	.0005	0.	0.	
337,000	25,000	.0886	....	.02	.04	
....	1,000	....	.0026	0.	0.	
350,480	26,000	.0929	....	.02	.04	
363,960	27,000	.0969	....	.02	.04	
377,440	28,000	.1010	....	.04	.04	
....	1,000	....	.0059	0.	.01	
390,920	29,000	.1059	....	.06	.04	
404,400	30,000	.1106	....	.07	.04	Elastic limit.
....	1,000	....	.0093	.03	.02	
417,880	31,000	.1170	....	.12	.04	
....	1,000	....	.0134	.07	.02	
430,700	31,950	....	....	....	....	Ultimate strength.
....	Load dropped to					
129,800	....	....	....	....	....	

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2046.

Built I column.
Pin ends.
Length of column, 12 feet 11¾ inches.
Length from center to center of pins, 13 feet 8¾ inches.
Weight, 615 pounds.
Sectional area, 13.53 square inches.
Initial deflection: Horizontal, ″.02; vertical, ″.10.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,530	1,000	0.	0.	0.	0.	Initial load.
67,650	5,000	.0122	....	0.	.01	
....	1,000	....	0.	0.	0.	
135,300	10,000	.0291	....	0.	.01	
....	1,000	....	0.	0.	0.	
202,950	15,000	.0460	....	0.	.01	
....	1,000	....	0.	0.	0.	
270,600	20,000	.0632	....	0.	.01	
....	1,000	....	0.	0.	0.	
338,250	25,000	.0814	....	0.	.02	
....	1,000	....	.0012	0.	0.	
351,780	26,000	.0855	....	.03	.02	
365,310	27,000	.0894	....	.03	.02	
378,840	28,000	.0934	....	.03	.02	
....	1,000	....	.0034	0.	0.	
392,370	29,000	.0966	....	.03	.02	Elastic limit.
405,900	30,000	.1033	....	.03	.02	
....	1,000	....	.0055	0.	0.	
419,430	31,000	.1083	....	.03	.02	
....	1,000	....	.0078	0.	.01	
447,500	33,070	....	....	....	....	Ultimate strength.
	Load dropped to					
115,600	....	....	....	....	....	

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2041.

Built I column.
Pin ends.
Length of column, 16 feet 5 inches.
Length from center to center of pins, 17 feet 2 inches.
Weight, 795½ pounds.
Sectional area, 13.86 square inches.
Initial deflection: Horizontal, ″.10; vertical, ″.08.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,860	1,000	0.	0.	0.	0.	Initial load.
69,300	5,000	.0144	....	0.	0.	
....	1,000	....	.0001	0.	0.	
138,600	10,000	.0321	....	.02	0.	
....	1,000	....	.0005	0.	0.	
207,900	15,000	.0497	....	.03	0.	
....	1,000	....	.0006	0.	0.	
277,200	20,000	.0674	....	.04	0.	
....	1,000	....	.0015	0.	0.	
346,500	25,000	.0864	....	.06	0.	
....	1,000	....	.0036	0.	0.	
360,360	26,000	.0903	....	.06	0.	
374,220	27,000	.0946	....	.06	.01	
388,080	28,000	.0991	....	.08	.01	
....	1,000	....	.0069	.01	.01	
401,940	29,000	.1040	....	.11	.02	
415,800	30,000	.1097	....	.21	.02	
....	1,000	....	.0125	.08	.02	
415,800	30,000	....	....	....	....	Ultimate strength.

The maximum stress was sustained until the horizontal deflection reached ″.21, whereupon the load was released and permanent sets measured. The loads were reapplied, and while at the maximum sudden springing occurred, the resistance dropping to 65,000 pounds total load.

Failed by flexure, deflecting perpendicular to the plane of the web.

No. 2042.

Built I column.
Pin ends.
Length of column, 16 feet 5 inches.
Length from center to center of pins, 17 feet 2 inches.
Weight, 798½ pounds.
Sectional area, 13.92 square inches.
Initial deflection: Horizontal, ″.06; vertical, ″.10.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,920	1,000	0.	0.	0.	0.	Initial load.
69,600	5,000	.0174	....	.02	.04	
....	1,000	....	.0015	0.	0.	
139,200	10,000	.0369	....	.04	.05	
....	1,000	....	.0015	0.	0.	
208,800	15,000	.0543	....	.06	.06	
....	1,000	....	.0015	0.	0.	
278,400	20,000	.0724	....	.08	.06	
....	1,000	....	.0025	0.	0.	
348,000	25,000	.0920	....	.10	.06	
....	1,000	....	.0058	.02	.02	
361,920	26,000	.0964	....	.12	.07	
375,840	27.000	.1015	....	.15	.07	
....	1,000	....	.0088	.02	.03	
389,760	28,000	....	....	.20	.07	
401,600	28,850	....	....	....	....	Ultimate strength.
	Load dropped to					
59,000	....	....	....	....	....	

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2043.

Built I column.
Pin ends.
Length of column, 16 feet 5 inches.
Length from center to center of pins, 17 feet 2 inches.
Weight, 797 pounds.
Sectional area, 13.89 square inches.
Initial deflection: Horizontal, ″.22; vertical, ″.08.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,890	1,000	0.	0.	0.	0.	Initial load.
69,450	5,000	.0147	....	0.	.01	
....	1,000	....	.0002	0.	0.	
138,900	10,000	.0324	....	.02	.01	
....	1,000	....	.0002	0.	0.	
208,350	15,000	.0495	....	.04	.01	
....	1,000	....	.0004	0.	0.	
277,800	20,000	.0675	....	.06	.01	
....	1,000	....	.0011	0.	0.	
347,250	25,000	.0869	....	.10	.01	
....	1,000	....	.0039	0.	0.	
361,140	26,000	.0914	....	.12	.01	
375,030	27,000	.0960	....	.14	.01	
388,920	28,000	.1021	....	.20	.01	
....	1,000	....	.0093	.06	.01	
399,200	28,740	....	....	....	....	Ultimate strength.
	Load dropped to					
84,000	....	....	....	....	....	

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2038.

Built I column.
Pin ends.
Length of column, 19 feet 10¼ inches.
Length from center to center of pins, 20 feet 7¼ inches.
Weight, 982 pounds.
Sectional area, 14.17 square inches.
Initial deflection: Horizontal, ''.03; vertical, ''.10.
Gauged length, taken on edge of web plate, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
14,170	1,000	0.	0.	0.	0.	Initial load.
70,850	5,000	.0095	....	0.	.05	
....	1,000	....	0.	0.	0.	
141,700	10,000	.0251	....	0.	.06	
....	1,000	....	0.	0.	0.	
212,550	15,000	.0415	....	0.	.08	
....	1,000	....	.0003	0.	0.	
283,400	20,000	.0588	....	.04	.10	
....	1,000	....	.0010	0.	0.	
297,570	21,000	.0625	....	.04	.10	
311,740	22,000	.0660	....	.05	.10	
325,910	23,000	.0696	....	.06	.10	
....	1,000	....	.0018	0.	.02	
340,080	24,000	.0737	....	.06	.10	
354,250	25,000	.0775	....	.08	.10	
....	1,000	....	.0029	0.	.02	
368,420	26,000	.0814	....	.11	.12	
382,590	27,000	.0859	....	.19	.12	
....	1,000	....	.0041	.04	.04	
388,300	27,400	....	....	....	....	Ultimate strength.
64,000	....	....	....	....	....	Resistance of column after sudden springing laterally.

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2039.

Built I column.
Pin ends.
Length of column, 19 feet 10¼ inches.
Length from center to center of pins, 20 feet 7¼ inches.
Weight, 985 pounds.
Sectional area, 14.21 square inches.
Initial deflection: Horizontal, ″.02; vertical, ″.10.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
14,210	1,000	0.	0.	0.	0.	Initial load.
71,050	5,000	.0109	....	.03	.04	
....	1,000	....	0.	0.	0.	
142,100	10,000	.0273	....	.03	.05	
....	1,000	....	0.	0.	.01	
213,150	15,000	.0434	....	.04	.05	
....	1,000	....	0.	0.	.01	
284,200	20,000	.0619	....	.05	.06	
....	1,000	....	.0005	0.	.01	
298,410	21,000	.0654	....	.05	.06	
312,620	22,000	.0690	....	.05	.06	
326,830	23,000	.0731	....	.06	.07	
....	1,000	....	.0015	.01	.02	
341,040	24,000	.0770	....	.06	.07	
355,250	25,000	.0810	....	.06	.07	
....	1,000	....	.0026	.01	.02	
369,460	26,000	.0855	....	.07	.07	
383,670	27,000	.0900	....	.09	.07	
397,880	28,000	.0950	....	.15	.07	
....	1,000	....	.0057	.03	.03	
402,300	28,310	....	....	....	....	Ultimate strength.
52,000	....	....	....	....	....	Resistance of column after sudden springing laterally.

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2040.

Built I column.
Pin ends.
Length of column, 19 feet 10¼ inches.
Length from center to center of pins, 20 feet 7¼ inches.
Weight, 960 pounds.
Sectional area, 13.84 square inches.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,840	1,000	0.	0.	0.	0.	Initial load.
69,200	5,000	.0121	....	0.	.02	
....	1,000	....	0.	0.	0.	
138,400	10,000	.0290	....	.02	.03	
....	1,000	....	0.	0.	0.	
207,600	15,000	.0461	....	.02	.03	
....	1,000	....	.0001	0.	0.	
276,800	20,000	.0639	....	.04	.04	
....	1,000	....	.0008	0.	0.	
290,640	21,000	.0675	....	.05	.04	
304,480	22,000	.0713	....	.05	.04	
318,320	23,000	.0751	....	.05	.04	
....	1,000	....	.0019	0.	0.	
332,160	24,000	.0792	....	.06	.04	
346,000	25,000	.0830	....	.06	.04	
....	1,000	....	.0030	0.	.01	
359,840	26,000	.0872	....	.08	.04	
373,680	27,000	.0916	....	.09	.04	
387,520	28,000	.0964	....	.12	.04	
....	1,000	....	.0056	.01	.01	
404,000	29,190	....	....	....	....	Ultimate strength.
57,500	Load dropped to	....	....	....	....	

Sudden springing sidewise occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2035.

Built I column.
Pin ends.
Length of column, 23 feet 3½ inches.
Length from center to center of pins, 24 feet ½ inch.
Weight, 1,116 pounds.
Sectional area, 13.72 square inches.
Initial deflection: Horizontal, ''.15; vertical, ''.14.
Gauged length, taken on edge of web plate, 100''.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,720	1,000	0.	0.	0.	0.	Initial load.
68,600	5,000	.0130		.10	.02	
	1,000		−.0003	0.	0.	
137,200	10,000	.0302		.22	.02	
	1,000		−.0003	.02	0.	
150,920	11,000	.0335		.25	.02	
164,640	12,000	.0372		.31	.02	
	1,000		−.0003	.04	0.	
178,360	13,000	.0408		.45	.02	
	1,000		−.0003	.05	0.	
180,200	13,130					Ultimate strength.
89,000						Resistance of column after sudden springing laterally.

Sudden springing occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2036.

Built I column.
Pin ends.
Length of column, 23 feet 3½ inches.
Length from center to center of pins, 24 feet ½ inch.
Weight, 1,118 pounds.
Sectional area, 13.74 square inches.
Initial deflection: Horizontal, 0″; vertical, 0″.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,740	1,000	0.	0.	0.	0.	Initial load.
68,700	5,000	.0131		.01	0.	
	1,000		−.0002	0.	0.	
137,400	10,000	.0300		.01	0.	
	1,000		−.0004	0.	0.	
206,100	15,000	.0468		.02	.02	
	1,000		−.0006	0.	0.	
274,800	20,000	.0642		0.	.02	
	1,000		−.0005	0.	0.	
288,540	21,000	.0680		.02	.02	
302,280	22,000	.0721		.02	.03	
316,020	23,000	.0760		.03	.04	
329,760	24,000	.0801		.04	.04	
343,500	25,000	.0840		.06	.04	
	1,000		+.0026	.01	.02	
357,240	26,000	.0874		.11	.04	
370,980	27,000	.0940		.24	.04	
	1,000		.0052	.04	.03	
371,100	27,010					Ultimate strength.
71,000						Resistance of column after sudden springing laterally.

Sudden springing occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

No. 2037.

Built I column.
Pin ends.
Length of column, 23 feet 3½ inches.
Length from center to center of pins, 24 feet ½ inch.
Weight, 1,125 pounds.
Sectional area, 13.83 square inches.
Initial deflection: Horizontal, ″.15; vertical, 0″.
Gauged length, taken on edge of web plate, 100″.
Counterweighted at middle.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
13,830	1,000	0.	0.	0.	0.	Initial load.
69,150	5,000	.0139	....	.03	0.	
....	1,000	....	.0004	.02	0.	
138,300	10,000	.0325	....	.03	.03	
....	1,000	....	.0007	.02	0.	
207,450	15,000	.0500	....	.06	.04	
....	1,000	....	.0010	.02	0.	
221,280	16,000	.0534	....	.06	.04	
235,110	17,000	.0568	....	.06	.04	
248,940	18,000	.0602	....	.08	.04	
....	1,000	....	.0015	.02	0.	
262,770	19,000	.0637	....	.10	.04	
276,600	20,000	.0673	....	.10	.04	
....	1,000	....	.0019	.02	0.	
290,430	21,000	.0707	....	.13	.04	
304,260	22,000	.0744	....	.19	.04	
....	1,000	....	.0025	.03	0.	
320,800	23,200	....	....	....	....	Ultimate strength.
81,000	....	....	....	....	....	Resistance of column after sudden springing laterally.

Sudden springing occurred when maximum load was reached, deflecting in a direction perpendicular to the plane of the web plate.

TABULATION OF COMPRESSION TESTS OF BUILT I COLUMNS, STEEL.

PIN ENDS.

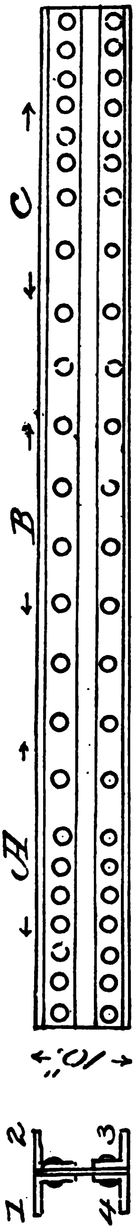
No. of test.	Length.			Sectional area.	Ultimate strength.	
	Feet.	Inches.	$\frac{l}{r}$		Total.	Per square inch.
				Sq. in.	*Pounds.*	*Pounds.*
2053	3	5¼	25	13.74	517,600	37,670
2054	3	5¼	25	13.74	520,300	37,870
2055	3	5¼	25	13.86	509,000	36,720
2050	6	10½	50	13.89	467,200	33,640
2051	6	10½	50	13.91	474,100	34,080
2052	6	10½	50	13.93	470,900	33,800
2047	10	3¾	75	13.76	444,100	32,270
2048	10	3¾	75	13.61	435,500	32,000
2049	10	3¾	75	13.87	445,400	32,110
2044	13	9	100	13.54	432,500	31,940
2045	13	8¾	100	13.48	430,700	31,950
2046	13	8¾	100	13.53	447,500	33,070
2041	17	2	125	13.86	415,800	30,000
2042	17	2	125	13.92	401,600	28,850
2043	17	2	125	13.89	399,200	28,740
2038	20	7¼	150	14.17	388,300	27,400
2039	20	7¼	150	14.21	402,300	28,310
2040	20	7¼	150	13.84	404,000	29,190
2035	24	¾	175	13.72	180,200	13,130
2036	24	¾	175	13.74	371,100	27,010
2037	24	¾	175	13.83	320,800	23,200

BUILT I COLUMNS, STEEL.

Compressometer observations made on flanges, at different parts of the lengths, of columns Nos. 2056 and 2057, also along center lines on edges of webs.

Gauged lengths on flanges....................................20″ each.
Gauged lengths on webs....................................50″ each.

Compressometer observations made, in succession, on individual gauged lengths A1, A2, etc., and, finally, simultaneous readings on web and A3, column No. 2056, and on web and B3 of column No. 2057.



COMPRESSION TESTS Nos. 2056 AND 2057.

GAUGED LENGTHS OF 20″ EACH TAKEN ON EACH FLANGE AT SECTIONS A, B, AND C.

No. 2056.

Built I column.
Flat ends.
Length, 8 feet 10.45 inches.
Weight, 430 pounds.
Sectional area, 13.81 square inches.

Gauged lengths of 20″ established on the four angles or flanges, 1, 2, 3, 4, one-eighth inch from the outer edges of flanges at A, B, C.

1, on top, east side.
2, on top, west side.
3, on bottom, west side.
4, on bottom, east side.
A, first point, 10″ from north end of column.
B, at center of column.
C, first point, 10″ from south end of column.

Applied loads.		On gauged lengths—							
		A1.		A2.		A3.		A4.	
Total.	Per square inch.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
13,810	1,000	0.	0.	0.	0.	0.	0.	0.	0.
69,050	5,000	.0015	....	.0028	....	.0035	....	.0030	....
138,100	10,000	.0049	....	.0060	....	.0070	....	.0065	....
207,150	15,000	.0084	0.	.0093	0.	.0105	0.	.0100	0.

Applied loads per square inch.	On gauged lengths—							
	B1.		B2.		B3.		B4.	
	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0025	....	.0025	....	.0025	....	.0030	....
10,000	.0057	....	.0057	....	.0056	....	.0064	....
15,000	.0091	0.	.0090	0.	.0090	0.	.0100	0.
	On gauged lengths—							
	C1.		C2.		C3.		C4.	
	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0030	....	.0026	....	.0022	....	.0030	....
10,000	.0065	....	.0062	....	.0054	....	.0065	....
15,000	.0100	0.	.0098	0.	.0088	0.	.0095	0.

Gauged length of 50″ at middle of column on edge of web plate.

Applied loads.		On gauged length.	
Total.	Per square inch.	Compression.	Set.
Pounds.	*Pounds.*	*Inch.*	*Inch.*
13,810	1,000	0.	0.
69,050	5,000	.0065	....
138,100	10,000	.0150	....
207,150	15,000	.0238	0.

Two extensometers adjusted on column. One of 50″ length at middle of column on edge of web plate, the other of 20″ length at A3.

Applied loads.		50″ length at middle of column.		20″ length at A3.	
Total.	Per square inch.	Compression.	Set.	Compression.	Set.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
13,810	1,000	0.	0.	0.	0.
69,050	5,000	.0063	0.	.0035	0.
138,100	10,000	.0145	0.	.0070	0.
207,150	15,000	.0230	−.0002	.0105	0.
276,200	20,000	.0316	0.	.0140	0.
345,250	25,000	.0410	.0005	.0181	.0006
359,060	26,000	.0430	....	.0190	....
372,870	27,000	.0456	....	.0200	....
386,680	28,000	.0478	.0022	.0210	.0017
400,490	29,000	.0498	....	.0215	....
414,300	30,000	.0526	.0031	.0227	.0023
428,110	31,000	.0553	....	.0239	....
441,920	32,000	.0580	....	.0254	....
455,730	33,000	.0622	.0085	.0290	.0065
469,540	34,000	.0703	.0210	.0468	.0184
		.0748			
477,700	34,590	Ultimate strength.			

Failed by triple flexure. Buckling the flanges and deflecting at middle of length sidewise to the west.

No. 2057.

Built **I** column.
Flat ends.
Length, 8 feet 10.43 inches.
Weight, 430½ pounds.
Sectional area, 13.83 square inches.

Gauged lengths of 20″ established on the four angles or flanges, 1, 2, 3, 4, ⅛″ from the outer edges of flanges at A, B, C.

1, on top, east side.
2, on top, west side.
3, on bottom, west side.
4, on bottom, east side.
A, first point 10″ from north end of column.
B, at center of column.
C, first point 10″ from south end of column.

Applied loads.		On gauged lengths—							
		A1.		A2.		A3.		A4.	
Total.	Per square inch.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
13,830	1,000	0.	0.	0.	0.	0.	0.	0.	0.
69,150	5,000	.0017	0.	.0020	....	.0035	....	.0032	....
138,300	10,000	.0050	0.	.0052	....	.0072	....	.0070	....
207,450	15,000	.0082	0.	.0084	—.0001	.0105	0.	.0106	0.

Applied loads per square inch.	On gauged lengths—							
	B1.		B2.		B3.		B4.	
	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0024	....	.0024	....	.0030	....	.0030	....
10,000	.0056	....	.0057	....	.0065	....	.0063	....
15,000	.0088	0.	.0092	0.	.0101	0.	.0098	0.

Applied loads per square inch.	On gauged lengths—							
	C1.		C2.		C3.		C4.	
	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.
1,000	0.	0.	0.	0.	0.	0.	0.	0.
5,000	.0030	....	.0026	....	.0026	....	.0029	....
10,000	.0063	....	.0060	....	.0058	....	.0061	....
15,000	.0098	0.	.0096	0.	.0093	0.	.0095	0.

Gauged length of 50″ at middle of column on edge of web plate.

Applied loads.		On gauged length.	
Total.	Per square inch.	Compression.	Set.
Pounds.	*Pounds.*	*Inch.*	*Inch.*
13,830	1,000	0.	0.
69,150	5,000	.0062	....
138,300	10,000	.0146	....
207,450	15,000	.0230	0.

Two extensometers adjusted on column. One of 50″ length at middle of column on edge of web plate, the other of 20″ length at B3.

Applied loads.		50″ length at middle of column.		20″ length at B^3.	
Total.	Per square inch.	Compression.	Set.	Compression.	Set.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
13,830	1,000	0.	0.	0.	0.
69,150	5,000	.0060	−.0001	.0030	0.
138,300	10,000	.0141	−.0002	.0066	0.
207,450	15,000	.0232	−.0002	.0101	0.
276,600	20,000	.0320	0.	.0139	0.
345,750	25,000	.0418	.0016	.0180	.0006
359,580	26,000	.0440	....	.0186	....
373,410	27,000	.0463	....	.0195	....
387,240	28,000	.0483	.0035	.0205	.0007
401,070	29,000	.0521	....	.0213	....
414,900	30,000	.0545	.0051	.0222	.0010
428,730	31,000	.0576	....	.0227	....
442,560	32,000	.0615	....	....	....
456,390	33,000	.0653	.0101	....	....
470,220	34,000	.0731	.0160	....	....
476,600	34,460	Ultimate strength.			

Failed by triple flexure, buckling the flanges, and deflecting at middle of length sidewise to the east.

No. 2088.

Built I columns.
Tested with flat ends.

Length over all.	Weight.	Pitch of rivets.	Number of rivets.	Sectional area.	Ultimate total.	Strength per square inch.
Inches.	*Pounds.*	*Inches.*		*Sq. in.*	*Pounds.*	*Pounds.*
20.65	85	3	14	14.20	551,200	33,810
20.65	85½	3	14	14.29	574,900	40,230
20.65	83½	6	6	14.14	526,300	37,220

Failed by buckling the flanges and web plates.

STEEL COLUMNS

ON WHICH LEUNER STRAIN RECORDERS WERE USED.

Five columns were tested on which records were made by the use of a number of Leuner strain recorders, in conformity with a recommendation that these instruments be used for the purpose of obtaining simultaneous readings on different sides of the test column.

Six Leuner instruments were loaned the arsenal by the American Bridge Company, and the services of Mr. A. P. Hume, mechanical engineer of the company, were made available to assist at these tests.

The columns on which these instruments were used were four latticed-channel columns and one wide-flange rolled shape. The latticed-channel columns represented four types of latticing, one of each, as shown on the cuts herewith.

The identifying numbers of the Leuner strain recorders and the maker's leverages of the same were as follows:

Number.	Maker's leverage.
252	134
255	134
256	138
257	143
258	139
261	136

The general appearance of these instruments is shown by the accompanying photograph, which illustrates the six instruments mounted along the edge of one flange of a 12″ by 12″ wide-flange shape.

The details appear in full pertaining to the tests of two columns, one an 8″ channel column single latticed, with lattice bars having independent ends, and one of the 12″ by 12″ wide-flange shapes.

The strain recorders were first applied to one of the flanges of the 8″ single latticed column, test No. 1910. This column had on an earlier occasion been loaded with a maximum stress of 20,000 pounds per square inch applied and released thirty-three times. It offered therefore a satisfactory column on which to ascertain the behavior of the instruments, as regards their indications under ascending and descending stresses, for loads confined within the abovementioned maximum. The instruments were applied in succession at the same place on the column, using a gauged length of 400 mm.= 15″.75, located about one-third the distance from the end of the column.

The order in which the several instruments were used and the results obtained are tabulated as follows:

Ordinates for total load.........lb..	8,080.	40,400.	161,600.	40,400.	8,080.
Stress ....lb. per sq. in..	1,000.	5,000.	20,000.	5,000.	1,000.
No. of instrument.	Instrument reading.				
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*
257	0.25	0.50	1.57	0.56	0.29
261	.21	.45	1.49	.48	.23
255	.19	.45	1.49	.49	.24
256	.22	.46	1.53	.52	.26
252	.29	.55	1.63	.61	.32
258	.27	.54	1.65	.59	.32

The following instruments were returned to the column in succession and redeterminations made:

Ordinates for total load.........lb..	8,080.	40,400.	161,600.	40,400.	8,080.
Stress...............lb. per sq. in..	1,000.	5,000.	20,000.	5,000.	1,000.
No. of instrument:	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
257	.35	.62	1.69	.66	.39
261	.28	.54	1.60	.60	.35

The initial load on the column was 1,000 pounds per square inch, and the ordinates entered under this load show the distance of the data lines of the respective instruments measured from the edge of the paper roll on which the strain diagram was traced.

Taking the differences of the ordinates and converting them into their values, according to the leverages of the instruments, the compressions and resiliences between loads of 5,000 and 20,000 pounds per square inch and apparent sets when the loads were returned to the initial ones were as follows:

No. of instrument.	Compressions.	Resiliences.	Apparent sets.
	5,000—20,000.	20,000—5,000.	Under 1,000.
	Inch.	*Inch.*	*Inch.*
257	.00748	.00706	.00028
261	.00764	.00743	.00015
255	.00776	.00746	.00037
256	.00775	.00732	.00029
252	.00806	.00761	.00022
258	.00799	.00763	.00036
257	.00748	.00720	.00028
261	.00779	.00735	.00051

The moduli of elasticity computed from the above compressions and resiliences are as follows:

No. of instrument.	Modulus of elasticity.	
	5,000—20,000.	20,000—5,000.
257	31,580,000	33,460,000
261	30,920,000	31,800,000
255	30,440,000	31,670,000
256	30,480,000	32,270,000
252	29,310,000	31,040,000
258	29,570,000	30,960,000
257	31,580,000	32,810,000
261	30,330,000	32,140,000

Inasmuch as these instruments were, in succession, applied to the same part of the column, it would be expected that the measured strains would be found identical in each case; that is, elastic deformations are expected to be the same in any given part of the column for the same range in stress when the loads are repeated. The different readings here found are attributed to the erratic behavior of the compressometers.

Under ascending stresses, recorder No. 252 gave the greatest strain, ″.00806, and No. 257 the least, ″.00748, a difference of ″.00058. The stress corresponding to this strain is $\frac{30M \times {}''.00058}{15.75} = 1{,}105$ pounds per square inch, or a total load on the column of 8,900 pounds.

Taking the difference between the extreme readings of the ascending and descending stresses, Nos. 252 and 257, we have ″.00806 − ″.00706 = ″.00100. This difference in strains corresponds to a stress per square inch of $\frac{30M \times {}''.00100}{15.75} = 1{,}905$ pounds, or a total load on the column of 15,300 pounds.

No reason is known which would tend to attach the cause of this erratic behavior to the testing machine, and it is believed that the cause resided in the strain recorders themselves.

Many of the computed moduli of elasticity are higher than expected, and while the lowest value is shown to be 29,310,000, many are above 30,000,000; one value reaching 33,460,000 pounds per square inch.

Some of these apparent compressions and resiliences are not thought to have actually existed in the column, but were due to the irregular behavior of the strain recorders. It was noticed that the pencils of the strain recorders which drew the automatic records did not advance with freedom. It was necessary to jar the instruments, whereupon the pencils would advance, increasing the ordinates from ″.10 to ″.12 each. All recorded ordinates were measured after the jarring of the instruments, which was necessary, however, but once for each applied stress. The values of the modulus of elasticity, above given, and other higher values, which will subsequently appear, would indicate that the ordinates of the automatic diagrams were not infrequently less than they should have been.

In describing the behavior of the Leuner instruments it might be added that provision was made by the designers to employ a magnetic release to control the movements of the mechanism for actuating the diagram rolls. It had been suggested that the several instruments might be controlled by means of this device, starting and stopping them simultaneously, and so forming the diagrams that the behavior of the different parts of the column covered by the instruments should be made known each at the same instant of time. While it would be attended with some inconvenience to continuously jar the six instruments to overcome their internal resistances, that might have been done had the mechanism otherwise responded satisfactorily. It was found, however, upon connecting the instruments in series and using the magnetic device that some of the instruments refused to start, while others having been once started refused to stop until a wedge was inserted.

For the purpose of the present demonstration, it was more economical of time to use the strain recorders without electric connections than undertake to get them into working order for such control.

It is understood that these six instruments, although they had been in the possession of the American Bridge Company for a period of about eight years, had not been used prior to the present tests.

It was apparent that the use of these instruments, on account of their large leverage, would be impracticable excepting on a very short-gauged length. The paper roll on which the diagrams were made had a width of 3½″, hence the ordinates representing the strains could not exceed that length. It was furthermore considered inexpedient to readjust the instruments during the progress of a test at such times as the stroke of the pencil approached the limit of movement on the paper roll.

The instruments were, in constuction, adapted for use on gauged lengths of 1 meter, 700 mm., and 400 mm., respectively. Taking the compression of the steel at one-thousandth of its length for a load of 30,000 pounds per square inch, stresses of 30,000 pounds per square inch would be expected during the tests, then the ordinates for the different-gauged lengths would be as follows for the instrument of 138 leverage:

$$\begin{aligned} 1\text{ meter} &= 39''.37 \times .001 \times 138 = 5''.43 \\ 700\text{ mm.} &= 37''.56 \times .001 \times 138 = 3''.80 \\ 400\text{ mm.} &= 15''.75 \times .001 \times 138 = 2''.17 \end{aligned}$$

From the above it is apparent that only the shortest length, 400 mm., was applicable in these tests. It would not be feasible to use a gauged length of "one-third the length of the column, but not to exceed 3 or 4 feet in any case," as recommended, excepting for a few of the columns, the shortest ones only of the series of some of the types.

This limitation in gauged length would not be experienced in the use of the instruments for the purpose for which they were designed—that is, in the measurement of strains in bridge members under the lower stresses due to ordinary live loads.

The moduli of elasticity as shown by the Leuner instruments for column No. 1910 at the middle of its length, four of the instruments being arranged, one on each of the four corners, were as follows:

No. of instrument.	Modulus of elasticity.
258	33,550,000
255	34,880,000
261	31,530,000
256	44,400,000

The above values were found for loads between 1,000 and 20,000 pounds per square inch, without deducting the sets which were shown by the instruments when the loads were released to the initial load of 1,000 pounds.

The values computed from the resiliencies, i. e., deducting the apparent sets, become:

No. of instrument.	Modulus of elasticity.
258	35,250,000
255	34,880,000
261	32,030,000
256	35,830,000

Each of these values is seen to be higher than would be expected.

This series of determinations, however, represents the highest values found in the use of these instruments, but in general the values were higher than those commonly met.

The permanent sets shown by the Leuner instruments were generally about one-third more than those shown by the arsenal compressometer.

Local differences in the compressibility of the columns, as the ultimate resistance was approached, were shown by the Leuner instruments, and those instruments which were on the concave side of the deflected column necessarily indicated a greater amount of local compression than displayed by the metal on the convex side. The usual deflection measurements on the lateral, bodily, movement of the column are also indexical of such differences in compressibility.

In respect to local overstraining experience has shown that such zones may be expected in the vicinity of rivet holes and where the metal has been cold straightened. It is sufficient to know where such cold straightening has been given the metal to judge of the locality in which the elastic limit will be early surpassed. The exact places where early sets are developed would require for their determination a large number of compressometers to be applied initially and maintained at the same places throughout the test. Attention is attracted to such places, however, by the disturbance of the scale on the surface of the metal, and in these tests the sound of scale leaving the metal occurred at such times as the compressometers showed a decided change in the rate of compression.

The use of the Leuner instruments was discontinued at the close of these tests.

It will be noted that the ultimate resistance of three of the latticed-channel columns was 33,000 pounds per square inch each, while the fourth latticed column, a single latticed one with the bars independently riveted to the channels, had an ultimate resistance of 32,000 pounds per square inch, while the wide-flanged rolled shape had an ultimate resistance of 27,000 pounds per square inch.

TABULATION OF COMPRESSION TESTS OF STEEL COLUMNS.

TESTED WITH FLAT ENDS.

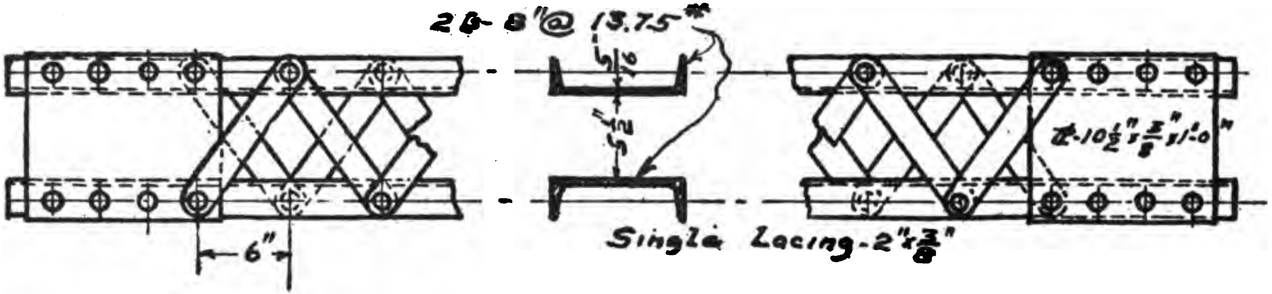
No. of test.	Type of column.	Length.			Sectional area.	Ultimate strength.	
		Feet.	Inches.	$\frac{l}{r}$		Total.	Per square inch.
					Sq. in.	*Pounds.*	*Pounds.*
1910	8″ channels, single latticed	18	7½	75	8.08	266,640	33,000
2085	8″ channels, single latticed bars with independent ends	18	7½	75	8.08	258,560	32,000
2084	8″ channels, double latticed	17	10½	72	8.08	266,640	33,000
2083	8″ channels double latticed and tie plates	17	10½	72	8.08	266,640	33,000
2082	12″ by 12″ wide-flanged rolled shape.	18	10	75	22.51	607,770	27,000

	MANNER OF FAILURE.
1910	Deflected perpendicular to webs of channels.
2085	Deflected perpendicular to webs of channels.
2084	Deflected chiefly in the direction parallel to webs of channels.
2083	Deflected perpendicular to webs of channels.
2082	Deflected perpendicular to web of section.

STEEL COLUMN, 8″ CHANNELS.

SINGLE LATTICED.

STEEL COLUMNS. TESTED WITH FLAT ENDS.



TEST No. 1910.
SINGLE LATTICED.

No. 1910.

COMPRESSION TEST OF STEEL COLUMN, TWO 8″ CHANNELS, WITH SINGLE LATTICING.

TESTED WITH FLAT ENDS.

Length over all, 18′ − 7″.22, $\frac{1}{r}=75$.

Weight, 765 pounds.

Sectional area, channels, 8.08 square inches.

Six Leuner Strain Recorders were used in the test of this column arranged in succession on each of the four flanges of the channels, after which four were placed, one on each flange near the middle of the length of the column and one on each flange near the south end of the channel which was on the east side of the column.

Prior to the use of the Leuner Strain Recorders the column was repeatedly loaded with a stress of 20,000 pounds per square inch while micrometer observations were made on the lattice bars, thirty-three in number, on one side of the column.

Parts of the results on this column appear on preceding pages; the remaining parts are in the tabulations which follow.

OBSERVATIONS MADE ON LATTICE BARS WITH GAUGED LENGTH OF 6″ ON EACH BAR.

Bars with odd numbers, upper ones.
Bars with even numbers, lower ones.

No. of lattice bar.	Compression of lattice bars on gauged lengths of 6″ each for loads on sectional area of column of—				
	Total pounds.				
	8,080.	80,800.	121,200.	161,600.	8,080.
	Pounds per square inch.				
	1,000.	10,000.	15,000.	20,000.	1,000.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	0.	0.	0.	.0001	0.
2	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	0.
12	0.	0.	0.	0.	0.
13	0.	0.	0.	.0001	0.
14	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.
16	0.	0.	0.	.0001	0.
17	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.
20	0.	0.	.0001	.0001	0.
21	0.	0.	0.	0.	0.
22	0.	0.	0.	0.	0.
23	0.	0.	0.	0.	0.
24	0.	0.	.0001	.0001	0.
25	0.	0.	0.	0.	0.
26	0.	0.	0.	0.	0.
27	0.	0.	0.	0.	0.
28	0.	0.	0.	0.	0.
29	0.	0.	0.	0.	0.
30	0.	0.	0.	0.	0.
31	0.	0.	0.	0.	0.
32	0.	0.	0.	0.	0.
33	0.	0.	.0001	.0002	0.

The six Leuner strain recorders were placed on the upper flange of the west channel at intervals along the length of the column.

The gauged lengths were 400 mm. = 15″.75 each.

The distances from north end of column to nearest extremity of each gauged length are shown in the tabulation which follows:

MEASURED ORDINATES.

Distances.		No. of instrument.	Total pounds.								
			8,080	40,400	80,800	121,200	161,600	121,200	80,800	40,400	8,080
			Pounds per square inch.								
Feet.	Inches.		1,000	5,000	10,000	15,000	20,000	15,000	10,000	5,000	1,000
			Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	5¼	258	.23	.37	.72	1.09	1.46	1.11	.75	.40	.27
4	5⅛	252	.20	.42	.78	1.13	1.49	1.15	.82	.47	.26
7	5	255	.30	.55	.90	1.23	1.57	1.27	.92	.58	.33
10	5⅛	256	.23	.48	.83	1.17	1.53	1.19	.84	.51	.26
13	5	261	.24	.52	.88	1.24	1.56	1.22	.87	.57	.28
15	6¾	257	.12	.43	.80	1.15	1.52	1.17	.82	.45	.12

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON EDGE OF LOWER FLANGE OF WEST CHANNEL.

1	9½	258	.25	.66	1.03	1.40	1.75	1.40	1.05	.68	.27
3	9½	252	.31	.65	1.02	1.38	1.72	1.39	1.06	.69	.36
6	9½	255	.50	.77	1.10	1.43	1.76	1.46	1.14	.82	.53
9	10½	256	.53	.80	1.13	1.45	1.80	1.47	1.16	.84	.57
12	9½	261	.42	.68	1.01	1.34	1.67	1.35	1.03	.70	.46
15	9¾	257	.25	.47	.80	1.13	1.47	1.15	.82	.49	.26

THE SIX LEUNER STRAIN RECORDERS MOUNTED ON UPPER FLANGE OF EAST CHANNEL.

1	9½	258	.33	.55	.89	1.24	1.60	1.27	.93	.60	.37
3	10½	252	.28	.48	.83	1.18	1.53	1.19	.86	.53	.33
6	10½	255	.36	.59	.92	1.24	1.57	1.27	.96	.63	.40
9	10½	256	.42	.69	1.05	1.41	1.77	1.44	1.09	.73	.45
12	11$\frac{1}{16}$	261	.29	.59	.98	1.35	1.71	1.37	1.01	.64	.33
15	10⅜	257	.30	.64	1.02	1.39	1.76	1.43	1.07	.71	.36

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON LOWER FLANGE OF EAST CHANNEL.

1	4⅝	258	.25	.56	.91	1.25	1.60	1.27	.93	.58	.27
3	6¼	252	.23	.58	.93	1.27	1.61	1.29	.94	.58	.24
6	6	255	.38	.70	1.05	1.39	1.72	1.41	1.08	.74	.41
9	6¼	256	.35	.64	.99	1.34	1.68	1.36	1.02	.64	.36
12	5⅝	261	.32	.59	.93	1.24	1.57	1.27	.95	.62	.37
15	6⅝	257	.43	.69	1.02	1.36	1.69	1.38	1.05	.73	.49

The six Leuner strain recorders were placed on the upper flange of the west channel at intervals along the length of the column.

The gauged lengths were 400 mm. = 15″.75 each.

The distances from north end of column to nearest extremity of each gauged length are shown in the tabulation which follows:

REDUCED ORDINATES OF THE LEUNER STRAIN DIAGRAMS, TAKEN FROM THE MEASURED ORDINATES OF THE PRECEDING TABLES.

Distances.		No. of instrument.	Total pounds.								
			8,080	40,400	80,800	121,200	161,600	121,200	80,800	40,400	8,080
			Pounds per square inch.								
Feet.	Inches.		1,000	5,000	10,000	15,000	20,000	15,000	10,000	5,000	1,000
			Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1	5½	258	.00101	.00252	.00266	.00266	.00252	.00259	.00252	.00093	.00029
4	5⅛	252	.00164	.00269	.00261	.00269	.00254	.00246	.00261	.00157	.00045
7	5	255	.00187	.00261	.00246	.00254	.00224	.00261	.00254	.00187	.00022
10	5⅛	256	.00181	.00253	.00246	.00261	.00246	.00253	.00239	.00253	.00022
13	5	261	.00206	.00265	.00265	.00230	.00248	.00255	.00219	.00212	.00029
15	6¼	257	.00217	.00259	.00245	.00259	.00245	.00245	.00259	.00231	0.

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON EDGE OF LOWER FLANGE OF WEST CHANNEL.

1	9½	258	.00295	.00266	.00266	.00252	.00262	.00252	.00266	.00295	.00014
3	9½	252	.00254	.00276	.00269	.00254	.00246	.00254	.00269	.00261	.00037
6	9½	255	.00201	.00246	.00246	.00246	.00224	.00239	.00239	.00216	.00022
9	10½	256	.00195	.00239	.00232	.00253	.00239	.00225	.00232	.00195	.00029
12	9½	261	.00191	.00242	.00242	.00242	.00230	.00230	.00241	.00175	.00029
15	9¾	257	.00154	.00231	.00231	.00238	.00224	.00231	.00231	.00161	.00007

THE SIX LEUNER STRAIN RECORDERS MOUNTED ON UPPER FLANGE OF EAST CHANNEL.

1	9½	258	.00158	.00245	.00252	.00259	.00237	.00245	.00237	.00165	.00029
3	10½	252	.00149	.00261	.00261	.00261	.00254	.00246	.00246	.00149	.00037
6	10½	255	.00172	.00246	.00239	.00246	.00224	.00231	.00246	.00172	.00030
9	10½	256	.00195	.00261	.00261	.00261	.00239	.00253	.00239	.00203	.00022
12	11 1/16	261	.00219	.00287	.00272	.00265	.00248	.00265	.00270	.00228	.00022
15	10⅝	257	.00238	.00266	.00259	.00259	.00231	.00245	.00252	.00245	.00042

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON LOWER FLANGE OF EAST CHANNEL.

1	4⅝	258	.00223	.00252	.00245	.00252	.00237	.00245	.00252	.00223	.00014
3	6¼	252	.00261	.00261	.00254	.00254	.00239	.00261	.00269	.00254	.00007
6	6	255	.00239	.00261	.00254	.00246	.00231	.00246	.00254	.00246	.00022
9	6⅛	256	.00210	.00253	.00253	.00246	.00232	.00246	.00275	.00203	.00007
12	5⅝	261	.00199	.00248	.00228	.00241	.00219	.00230	.00241	.00184	.00037
15	6⅝	257	.00154	.00231	.00238	.00231	.00217	.00231	.00224	.00168	.00014

Six Leuner strain recorders used on flanges of channels, four near middle of length of column, encircling the column, and two on the east channel nearer the south end, located as follows:

No. of instrument.	Placed on—	Distance from south end of column.	
		Feet.	Inches.
258	West channel, upper flange	9	4½
255	West channel, lower flange	9	9½
261	East channel, lower flange	9	2
256	East channel, upper flange	9	8⅝
257	East channel, lower flange	6	1¾
252	East channel, upper flange	5	8¼

LEUNER STRAIN RECORDERS.

Applied loads.		Deflections.		No. 258.	No. 255.	No. 261.	No. 256.	No. 257.	No. 252.
Total.	Per square inch.	Horizontal.	Vertical.						
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
8,080	1,000	....	....	.23	.10	.15	.09	.11	.20
40,400	5,000	....	....	.48	.36	.41	.24	.37	.47
80,800	10,000	....	....	.81	.68	.76	.45	.70	.80
121,200	15,000	....	....	1.14	.97	1.10	.71	1.04	1.13
161,600	20,000	....	....	1.47	1.25	1.44	1.02	1.37	1.46
....	1,000	0.	0.	.29	.10	.17	.28	.12	.25
202,000	25,000	.01	.01	1.81	1.53	1.80	1.35	1.68	1.81
....	1,000	....	....	.31	.10	.23	.34	.12	.28
210,080	26,000	.02	.01	1.92	1.60	1.93	1.48	1.77	1.94
218,160	27,000	.02	.01	1.99	1.65	2.03	1.54	1.84	2.02
226,240	28,000	.02	.01	2.06	1.71	2.14	1.62	1.92	2.13
234,320	29,000	.02	.01	2.13	1.75	2.27	1.70	2.02	2.24
242,400	30,000	.02	.01	2.28	1.82	2.40	1.79	2.13	2.38
....	1,000	0.	0.	.42	.13	.47	.52	.24	.51
250,480	31,000	.02	.01	2.40	1.89	2.55	1.92	2.24	2.52
258,560	32,000	.03	.01	2.51	1.92	2.74	2.05	2.34	2.65
266,640	33,000	.10	.01	2.57	1.83	3.28	2.30	2.45	3.25
....	1,000	.09	.01	.55	.05	1.12	.82	.40	1.34
266,640	33,000	.50	.01	Ultimate strength.			....	....	....
225,000	....	1.60	....	....	....	....	....	....	....
202,000	....	2.70	....	....	....	....	....	....	....
8,080	1,000	2.32	....	Test discontinued.					

Column failed by deflecting laterally perpendicular to the webs of the channels.

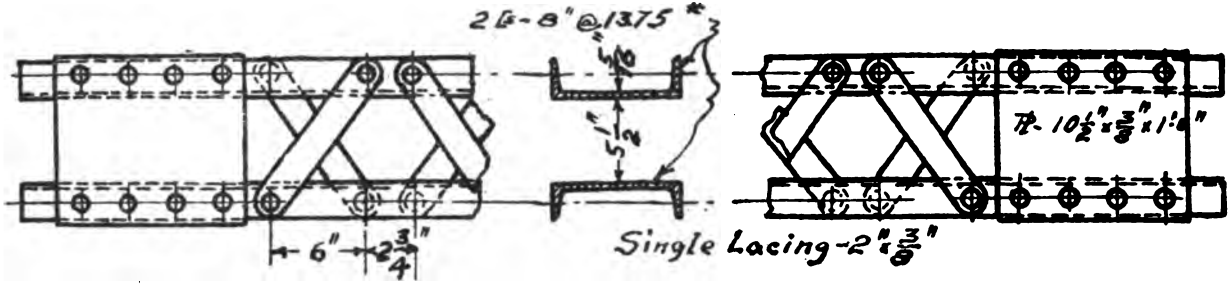
LEUNER STRAIN RECORDERS.

Applied loads per square inch.	Reduced ordinates.					
	No. 258.	No. 255.	No. 261.	No. 256.	No. 257.	No. 252.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00180	.00194	.00191	.00109	.00182	.00201
10,000	.00417	.00433	.00448	.00260	.00413	.00448
15,000	.00654	.00648	.00699	.00449	.00650	.00694
20,000	.00892	.00858	.00949	.00674	.00881	.00940
1,000	.00043	0.	.00015	.00138	.00007	.00037
25,000	.01137	.01067	.01213	.00913	.01098	.01201
1,000	.00058	0.	.00059	.00181	.00007	.00060
26,000	.01215	.01119	.01309	.01007	.01160	.01299
27,000	.01266	.01157	.01382	.01051	.01210	.01358
28,000	.01316	.01201	.01463	.01109	.01267	.01440
29,000	.01367	.01231	.01559	.01166	.01335	.01522
30,000	.01475	.01284	.01654	.01232	.01412	.01627
1,000	.00137	.00022	.00235	.00312	.00091	.00231
31,000	.01561	.01335	.01765	.01326	.01490	.01731
32,000	.01640	.01358	.01904	.01420	.01559	.01828
33,000	.01683	.01291	.02301	.01601	.01636	.02276
1,000	.00230	.00037	.00713	.00167	.00203	.00850

STEEL COLUMN, 8″ CHANNELS.

SINGLE LATTICED, INDEPENDENT ENDS.

STEEL COLUMNS. TESTED WITH FLAT ENDS.



TEST No. 2085.

LATTICE BARS WITH INDEPENDENT ENDS.

No. 2085.

COMPRESSION TEST OF STEEL COLUMN, TWO 8″ CHANNELS, SINGLE LATTICED. LATTICE BARS WITH INDEPENDENT ENDS.

TESTED WITH FLAT ENDS.

Length over all, 18′-7¼″, $\frac{l}{r}=75$.

Weight, 710 pounds.

Sectional area, channels, 8.08 square inches.

Gauged lengths: With arsenal compressometer on center line of web of upper channel, 100 inches; with Leuner strain recorders on flanges of channels, 400 mm. = 15″.75 each.

Four of the Leuner strain recorders, Nos. 255, 261, 258, and 256, were located at the middle of the length of the column, one on each flange.

Of the two additional instruments, one (No. 257) was located at a distance of 18″ from the north end of the column, the other (No. 252) at the same distance from the south end, and each was placed on the west flange of the upper channel.

The loads applied to the column, the compressions and sets shown by the arsenal compressometer; the deflections, horizontal and vertical; and the ordinates as measured on the diagrams of the Leuner strain recorders are tabulated as follows:

Applied loads.		Arsenal compressometer (gauged length, 100″).		Deflections.		Leuner strain recorders.					
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	No. 257.	No. 255.	No. 261.	No. 258.	No. 256.	No. 252.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
8,080	1,000	0.	0.	0.	0.	.20	.15	.15	.14	.13	.13
40,400	5,000	.0130	....	0.	0.	.40	.41	.43	.47	.32	.49
80,800	10,000	.0310	....	0.	0.	.75	.78	.82	.88	.70	.90
....	1,000	....	0.	0.	0.	.23	.19	.21	.19	.15	.17
121,200	15,000	.0474	....	0.	.02	1.08	1.14	1.16	1.28	1.06	1.27
....	1,000	....	.0004	0.	0.	.26	.21	.23	.22	.15	.18
161,600	20,000	.0651	....	0.	.03	1.45	1.51	1.52	1.68	1.47	1.64
....	1,000	....	.0011	0.	0.	.27	.25	.29	.26	.18	.20
202,000	25,000	.0849	....	0.	.07	1.88	2.03	1.94	2.10	1.96	2.05
....	1,000	....	.0041	0.	0.	.30	.42	.40	.29	.28	.27
....	1,000	....	.0050	0.	0.	.32	.43	.37	.27	.27	.27
Rested 17 hours under initial load											
210,080	26,000	.0898	....	0.	.08	1.94	2.17	2.08	2.22	2.06	2.16
218,160	27,000	.0942 .0957	....	0.	.10	2.07	2.30	2.18	2.33	2.19	2.27
226,240	28,000	.0994	....	0.	.10	2.20	2.42	2.38	2.54	2.35	2.39
234,320	29,000	.1054	....	0.	.11	2.33	2.57	2.56	2.72	2.54	2.63
242,400	30,000	.1102 .1106	....	0.	.15	2.53	2.70	2.72	3.11	2.71	3.08
....	1,000	....	.0122	0.	.10	.55	.73	.93	.95	.67	1.13
250,480	31,000	.1142 .1119	....	0. 0.	.24 .40	3.12	2.66	3.23	....	2.74	....
....	1,000	....	.0124	0.	.25	1.08	.56	1.46	....	.65	....
258,560	32,000	....	....	0.	.79	Ultimate strength.					

Column failed by deflecting upward perpendicular to the webs of the channels.

Column was bent until the deflection at the middle reached a permanent set of 3″.90.

Channels took sharp bends between latticing at middle of length of column and next the plates at ends on the concave sides of the bends.

Sustained maximum stress momentarily.

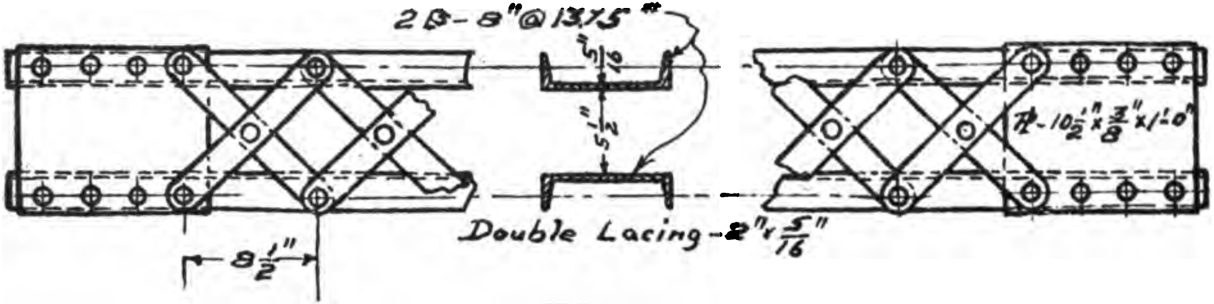
LEUNER STRAIN RECORDERS.

Applied loads per square inch.	Reduced ordinates.					
	No. 257.	No. 255.	No. 261.	No. 258.	No. 256.	No. 252.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00140	.00194	.00206	.00237	.00138	.00268
10,000	.00385	.00470	.00493	.00532	.00413	.00575
1,000	.00021	.00030	.00044	.00086	.00014	.00030
15,000	.00615	.00739	.00743	.00820	.00674	.00851
1,000	.00042	.00045	.00059	.00058	.00014	.00037
20,000	.00814	.01015	.01007	.01100	.00971	.01127
1,000	.00049	.00075	.00103	.00086	.00036	.00052
25,000	.01161	.01402	.01316	.01410	.01348	.01433
1,000	.00069	.00127	.00184	.00108	.00109	.00104
1,000	.00084	.00134	.00162	.00094	.00101	.00104
Rested 17 hours under initial load.						
26,000	.01217	.01507	.01419	.01496	.01398	.01515
27,000	.01308	.01604	.01492	.01576	.01493	.01597
28,000	.01399	.00948	.01640	.01727	.01609	.01686
29,000	.01490	.01806	.01772	.01856	.01746	.01865
30,000	.01629	.01903	.01890	.02137	.01870	.02201
1,000	.00245	.00433	.00574	.00583	.00391	.00746
31,000	.02042	.01873	.02265	....	.01891	....
1,000	.00615	.00306	.00963	....	.00377	....

STEEL COLUMN, 8″ CHANNELS.

DOUBLE LATTICED.

STEEL COLUMNS. TESTED WITH FLAT ENDS.



TEST No. 2084.

DOUBLE LATTICED.

No. 2084.

COMPRESSION TEST OF STEEL COLUMN, TWO 8″ CHANNELS, DOUBLE LATTICED.

TESTED WITH FLAT ENDS.

Length over all, 17′ 10½″, $\frac{1}{r} = 72$.

Weight, 811 pounds.

Sectional area, channels, 8.08 square inches.

Gauged lengths: With arsenal compressometer on center line of web of upper channel, 100 inches; with Leuner strain recorders on flanges of channels, 400 mm. = 15″.75 each.

Four of the Leuner strain recorders, Nos. 258, 261, 256, and 252, were located at the middle of the length of the column, one on each flange.

Of the two additional instruments, one (No. 255) was located at a distance of 13½″ from the north end of the column, the other (No. 257) at a distance of 14½″ from the south end, and each was placed on the west flange of the upper channel.

The loads applied to the column, the compressions and sets shown by the arsenal compressometer, the deflections, horizontal and vertical, and the ordinates as measured on the diagrams of the Leuner strain recorders are tabulated as follows:

Applied loads.		Arsenal compressometer (gauged length, 100″).		Deflections.		Leuner strain recorders.					
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	No. 255.	No. 258.	No. 261.	No. 256.	No. 252.	No. 257.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
8,080	1,000	0.	0.	0.	0.	.19	.25	.20	.20	.25	.17
40,400	5,000	.0129	....	0.	0.	.36	.50	.48	.51	.51	.48
80,800	10,000	.0296	....	0.	0.	.66	.83	.83	.90	.84	.86
....	1,000	....	0005	0.	0.	.21	.27	.26	.27	.27	.21
121,200	15,000	.0470	....	0.	0.	.98	1.17	1.22	1.31	1.18	1.27
....	1,000	....	.0018	0.	0.	.25	.29	.30	.31	.28	.26
161,600	20,000	.0651	....	0.	.02	1.33	1.52	1.67	1.73	1.55	1.72
....	1,000	....	.0043	0.	0.	.30	.31	.40	.38	.31	.34
202,000	25,000	.0853	....	0.	.02	1.73	1.90	2.22	2.22	1.92	2.21
....	1,000	....	.0065	0.	0.	.38	.35	.59	.48	.38	.46
210,080	26,000	.0901	....	.01	.02	1.84	1.98	2.37	2.37	2.03	2.34
218,160	27,000	.0951	....	.01	.02	1.93	2.06	2.50	2.49	2.09	2.45
226,240	28,000	.1005	....	.01	.03	2.03	2.15	2.66	2.62	2.16	2.57
234,320	29,000	.1062	....	.01	.04	2.14	2.26	2.84	2.76	2.23	2.70
242,400	30,000	.1120 .1134	....	.01	.04	2.25	2.38	3.04	2.90	2.30	2.83
....	1,000	....	.0174	0.	0.	.60	.56	1.01	.72	.50	.76
250,480	31,000	.1197 .1229	....	.01	.06	2.41	2.52	3.33	3.28	2.32	3.01
....	1,000	....	.0231	0.	0.	.67	.67	1.54	1.08	.42	.90
258,560	32,000	.1296 .1406	....	.02 .10	.09 .12	2.64	2.76	....	....	2.15	3.34
266,640	33,000	....	....	.45	.28	Ultimate strength.					

Sustained maximum stress momentarily.

Deflected chiefly in a horizontal direction parallel to the planes of the webs of the channels.

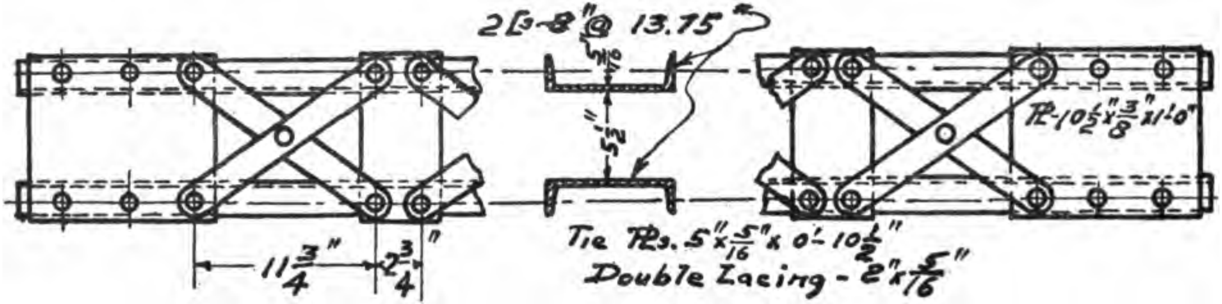
LEUNER STRAIN RECORDERS.

Applied loads per square inch.	Reduced ordinates.					
	No. 255.	No. 258.	No. 261.	No. 256.	No. 252.	No. 257.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00127	.00180	.00206	.00225	.00194	.00217
10,000	.00351	.00417	.00463	.00507	.00440	.00482
1,000	.00015	.00014	.00044	.00051	.00015	.00028
15,000	.00590	.00662	.00750	.00804	.00694	.00769
1,000	.00045	00029	.00073	.00080	.00022	.00063
20,000	.00850	.00914	.01081	.01108	.00970	.01084
1,000	.00082	.00043	.00147	.00130	.00045	.00119
25,000	.01149	.01187	.01485	.01463	.01246	.01427
1,000	.00142	.00072	.00287	.00203	.00097	.00203
26,000	.01231	.01245	.01596	.01572	.01328	.01517
27,000	.01299	.01302	.01691	.01659	.01373	.01594
28,000	.01873	.01367	.01809	.01754	.01425	.01681
29,000	.01455	.01446	.01941	.01855	.01477	.01769
30,000	.01537	.01532	.02088	.01956	.01528	.01860
1,000	.00306	.00223	.00595	.00377	.00187	.00413
31,000	.01657	.01633	.02301	.02242	.01545	.01986
1,000	.00358	.00302	.00965	.00638	.00127	.00510
32,000	.01828	.01806	....	....	.01418	.02217

STEEL COLUMN, 8″ CHANNELS.

DOUBLE LATTICED, WITH TIE PLATES.

STEEL COLUMNS. TESTED WITH FLAT ENDS.


2[3-8" @ 13.75#
5/16
5 1/2"
Pl-10 1/2" x 3/8" x 1'-0"
11 3/4"
2 3/4"
Tie Pls. 5" x 5/16" x 0'-10 1/2"
Double Lacing - 2" x 5/16"

TEST No. 2083.

DOUBLE LATTICED, WITH TIE PLATES.

No. 2083.

COMPRESSION TEST OF STEEL COLUMN, TWO 8″ CHANNELS, WITH DOUBLE LATTICING AND TIE PLATES.

TESTED WITH FLAT ENDS.

Length over all, 17′ – 10½″, $\frac{l}{r}=72$.

Weight, 850 pounds.

Sectional area, channels, 8.08 square inches.

Gauged lengths: With arsenal compressometer on center line of web of upper channel, 100 inches; with Leuner strain recorders on flanges of channels, 400 mm. = 15″.75 each.

Four of the Leuner strain recorders, Nos. 252, 256, 258, and 261, were located at the middle of the length of the column, one on each flange.

Of the two additional instruments, one (No. 255) was located at a distance of 29″ from the north end of the column, the other (No. 257) at a distance of 25″ from the south end, and each was placed on the west flange of the upper channel.

The loads applied to the column, the compressions and sets shown by the arsenal compressometer; the deflections, horizontal and vertical; and the ordinates as measured on the diagrams of the Leuner strain recorders are tabulated as follows:

Applied loads.		Arsenal compressometer (gauged length, 100″).		Deflections.		Leuner strain recorders.					
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	No. 255.	No. 252.	No. 256.	No. 258.	No. 261.	No. 257.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*In.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
8,080	1,000	0.	0.	0.	0.	.23	.19	.28	.29	.18	.17
40,400	5,000	.0111	....	0.	0.	.38	.41	.55	.54	.35	.46
80,800	10,000	.0265	....	0.	0.	.69	.74	.90	.88	.63	.81
....	1,000	....	.0005	0.	0.	.25	.21	.38	.30	.18	.20
121,200	15,000	.0427	....	0.	0.	1.01	1.05	1.30	1.25	.93	1.15
....	1,000	....	.0011	0.	0.	.25	.24	....	.34	.18	.23
161,600	20,000	.0580	....	0.	.02	1.25	1.32	1.60	1.52	1.15	1.42
....	1,000	....	.0018	0.	0.	.28	.25	.47	.36	.19	.25
202,000	25,000	.0779	....	0.	.05	1.67	1.72	2.11	2.08	1.54	1.93
....	1,000	....	.0041	0.	0.	.32	.30	.58	.49	.20	.32
210,080	26,000	.0803	....	.01	.07	1.73	1.80	2.22	2.21	1.61	2.01
218,160	27,000	.0843	....	.01	.08	1.81	1.87	2.31	2.30	1.68	2.08
226,240	28,000	.0882	....	.01	.09	1.88	1.93	2.39	2.42	1.74	2.17
234,320	29,000	.0925	....	.01	.09	1.96	2.01	2.51	2.51	2.80	2.25
242,400	30,000	.0971	....	.02	.10	2.03	2.07	2.64	2.69	1.87	2.34
....	1,000	....	.0087	0.	.05	.35	.33	.79	.74	.25	.41
250,480	31,000	.1018	....	.02	.10	2.13	2.14	2.82	2.86	1.94	2.40
258,560	32,000	.1057	....	.02	.12	2.25	2.16	3.08	3.14	1.97	2.40
266,640	33,000	.1109	....	.03	.19	2.44	2.14	3.40	3.35	1.95	2.50
		.1114	....	.03	.21						
....	1,000	....	.0136	.01	.15	.45	.22	1.64	1.56	.12	.41
266,640	33,000	....	....	....	.22	2.45	2.04	....	....	1.74	2.59
		.1115	....	....	.35	....	....	....	....	....	....
		.1110	....	....	.39	....	....	....	....	....	....
		.1106	....	....	.41	After sustaining load 25 minutes.					
....	1,000	....	.0148	0.	.34	....	....	....	....	....	....
....	1,000	....	.0138	....	....	After resting 40 hours under initial load.					
266,640	33,000	.1092	....	0.	.42	Ultimate strength.					
		.1094	....	.02	.46	After sustaining load 15 minutes.					
		....	....	.02	.57	After sustaining load 40 minutes.					
		.1066	....	.02	.60	After sustaining load 45 minutes.					
		.0970	....	.03	.90	After sustaining load 50 minutes.					
250,000	....	....	....	.04	1.40	....	....	....	....	....	....
225,000	....	....	....	.04	2.57	Test discontinued.					

Column deflected upward at middle of length perpendicular to the plane of the webs of the channels.

Lattice bars at sections at middle of length and places of contraflexure near ends of column were bent outward as the deflection of the column was increased.

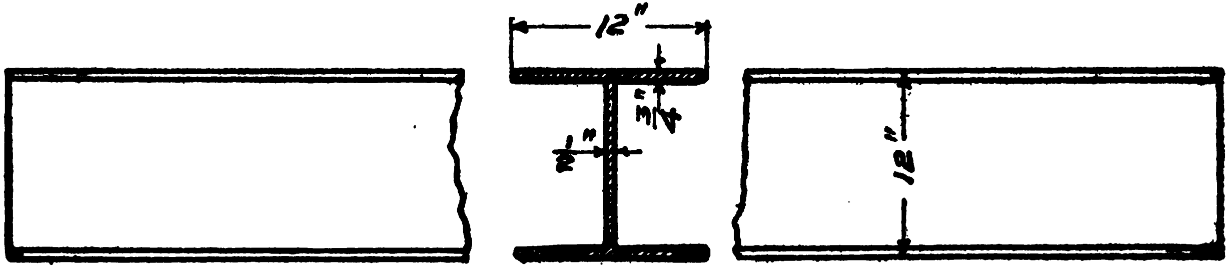
LEUNER STRAIN RECORDERS.

Applied loads per square inch.	Reduced ordinates.					
	No. 257.	No. 255.	No. 261.	No. 258.	No. 256.	No. 252.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00112	.00164	.00196	.00180	.00125	.00203
10,000	.00343	.00411	.00449	.00424	.00331	.10448
1,000	.00015	.00015	.00072	.00007	0.	.00021
15,000	.00584	.00642	.00739	.00690	.00551	.00685
1,000	.00015	.00037	....	.00036	0.	.00042
20,000	.00761	.00843	.00957	.00885	.00713	.00874
1,000	.00037	.00045	.00137	.00050	.00007	.00056
25,000	.01074	.01142	.01326	.01288	.01000	.01231
1,000	.00067	.00082	.00217	.00144	.00015	.00105
26,000	.01119	.01201	.01406	.01381	.01051	.01287
27,000	.01179	.01254	.01471	.01446	.01103	.01336
28,000	.01231	.01299	.01529	.01532	.01147	.01399
29,000	.01291	.01358	.01616	.01597	.01191	.01455
30,000	.01343	.01403	.01710	.01726	.01243	.01517
1,000	.00090	.00104	.00370	.00324	.00051	.00168
31,000	.01418	.01455	.01841	.01849	.01294	.01559
32,000	.01507	.01470	.02029	.02050	.01316	.01559
33,000	.01649	.01455	.02261	.02201	.01301	.01627
1,000	.00164	.00022	.00986	.00913	.00044	.00168
33,000	.01657	.01381	....	....	.01147	.01692

STEEL COLUMN.

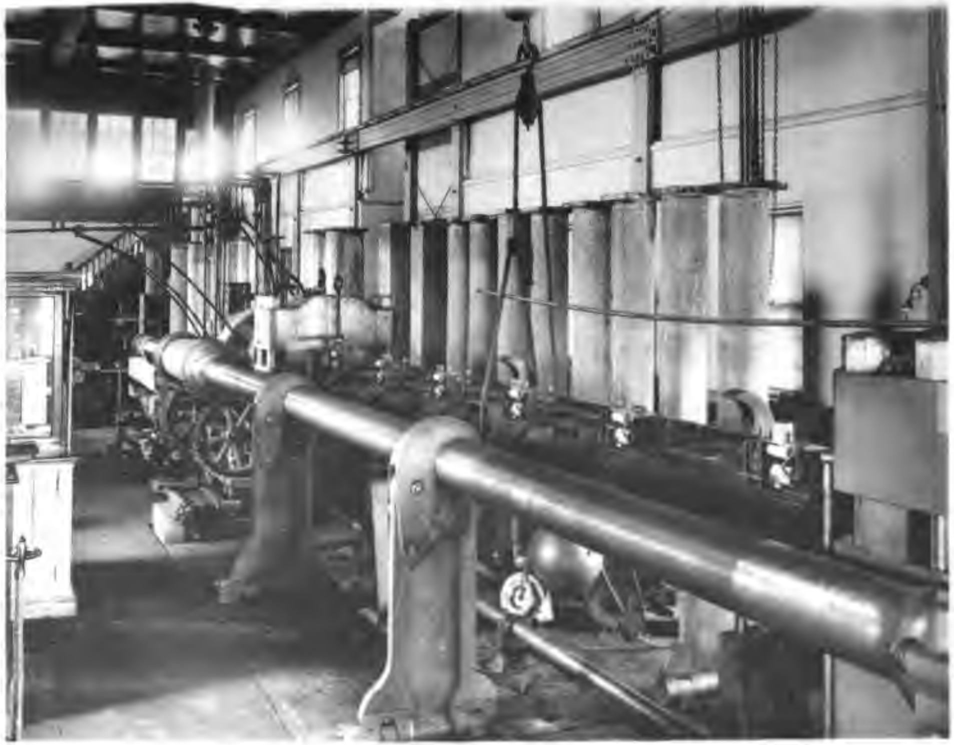
WIDE-FLANGED ROLLED H SHAPE.

STEEL COLUMNS. TESTED WITH FLAT ENDS.



TEST No. 2082.

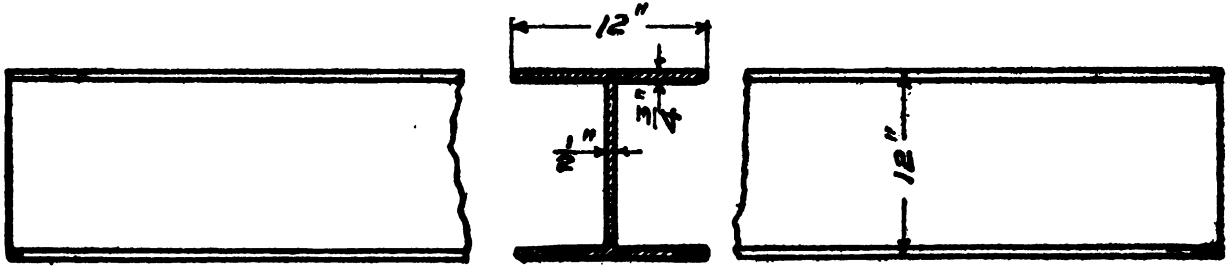
WIDE FLANGED, ROLLED H SHAPE



No. 2082.

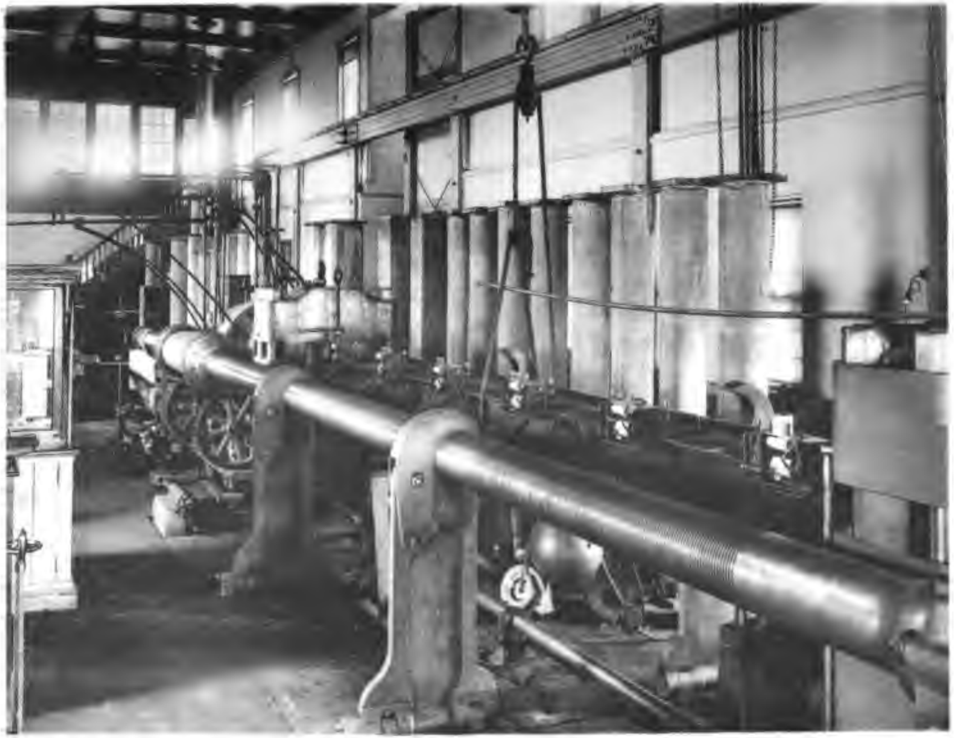
SIX LEUNER STRAIN RECORDERS MOUNTED ON FLANGE OF ROLLED SHAPE.

STEEL COLUMNS. TESTED WITH FLAT ENDS.



TEST No. 2082.

WIDE FLANGED, ROLLED H SHAPE



No. 2082.

SIX LEUNER STRAIN RECORDERS MOUNTED ON FLANGE OF ROLLED SHAPE.

No. 2082.

COMPRESSION TEST OF 12″ BY 12″ WIDE-FLANGED ROLLED SHAPE.

Length over all, 18′ 10″, $\frac{l}{r}=75$.

Weight, 1,441 pounds.

Sectional area, 22.51 square inches.

Gauged lengths: With arsenal compressometer, taken along center line of flange over web, 100 inches; with each Leuner strain recorder, taken on edges of flanges, 400 mm. = 15.75 inches.

The six Leuner strain recorders were used successively on the four edges of each flange of the rolled shape and were located equidistant from each other.

Initial observations were made with loads up to 20,000 pounds per square inch, after which the positions of the Leuner strain recorders were changed, four of them being now located on each of the four flanges at the middle of the length of the rolled shape. The two remaining instruments were placed on the edges of the two lower flanges at a distance of about 4′ ¾″ from one end of the column.

Observations with Leuner strain recorders located on upper west flange.

Distances of strain recorders from end of column and the identifying numbers of the instruments appear over the tabulation showing the ordinates measured on the diagrams of the several instruments, the numbers of the several instruments and their leverages being as follows:

	Leverage.
No. 252	134
No. 255	134
No. 256	138
No. 257	143
No. 258	139
No. 261	136

Applied loads.		Arsenal compressometer (gauged length, 160″).		Leuner strain recorders.					
Total.	Per square inch.	Compression.	Set.	0′ 11″, No. 258.	4′ ¾″, No. 257.	7′ 2¼″, No. 256.	10′ 4″, No. 255.	13′ 5¼″, No. 252.	16′ 7¼″, No. 261.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
22,510	1,000	0.	0.	.24	.15	.28	.21	.25	.24
112,550	5,000	.0127	....	.46	.40	.51	.45	.51	.46
....	1,000	....	0.	.24	.17	.30	.21	.25	.27
225,100	10,000	.0298 .0313	....	.79	.77	.89	.83	.85	.80
....	1,000	....	.0023	.31	.23	.38	.26	.29	.31
337,650	15,000	.0505 .0511	....	1.21	1.19	1.31	1.22	1.32	1.23
....	1,000	....	.0055	.42	.33	.47	.33	.38	.44
360,160	16,000	.0542 .0546	....	1.31	1.28	1.40	1.32	1.41	1.32
382,670	17,000	.0584 .0586	....	1.38	1.38	1.50	1.40	1.49	1.40
405,180	18,000	.0629 .0634	....	1.45	1.47	1.59	1.51	1.59	1.48
427,690	19,000	.0676	....	1.52	1.54	1.69	1.61	1.70	1.57
450,200	20,000	.0722 .0732	....	1.60	1.64	1.71	1.72	1.81	1.68
....	1,000	....	.0104	.49	.42	.66	.46	.54	.60

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON UPPER EDGE OF EAST FLANGE OF H SHAPE.

22,510	1,000	0.	0.	.15	.22	.23	.34	.27	.18
112,550	5,000	.0129	....	.42	.47	.47	.59	.56	.42
225,100	10,000	.0293	....	.78	.82	.79	.92	.91	.77
337,650	15,000	.0460	....	1.13	1.17	1.14	1.25	1.25	1.10
450,200	20,000	.0627	....	1.49	1.53	1.48	1.58	1.59	1.42
....	1,000	....	.0003	.21	.27	.28	.38	.31	.18

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON LOWER EDGE OF EAST FLANGE OF H SHAPE.

22,510	1,000	0.	0.	.20	.21	.19	.29	.22	.24
112,550	5,000	.0129	....	.46	.48	.39	.50	.49	.46
225,100	10,000	....	....	.80	.84	.72	.81	.83	.80
337,650	15,000	.0461	....	1.15	1.20	1.06	1.12	1.18	1.12
450,200	20,000	.0626	....	1.49	1.56	1.40	1.43	1.52	1.47
....	1,000	....	.0001	.22	.24	.22	.33	.24	.25

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON LOWER EDGE OF WEST FLANGE OF H SHAPE.

22,510	1,000	0.	0.	.24	.20	.19	.22	.27	.24
112,550	5,000	.0129	....	.55	.50	.40	.49	.53	.45
225,100	10,000	.0293	....	.89	.84	.73	.83	.88	.80
337,650	15,000	.0460	....	1.24	1.18	1.08	1.16	1.22	1.13
450,200	20,000	.0624	....	1.56	1.52	1.42	1.50	1.55	1.46
....	1,000	....	0.	.25	.23	.20	.25	.29	.26

Four Leuner instruments, Nos. 255, 252, 257, 256, at middle of length of column.

Nos. 258, 261, 4′ ¾″ from end.

Instruments at 4′ ¾″ from upper end.

Instruments at middle, or 8′ 9½″ from upper end to north end of gauged length of 400 mm.

Applied loads.		Arsenal compressometer. Gauged length, 100″.		Deflections.		Leuner strain recorders.					
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	No. 255.	No. 252.	No. 257.	No. 256.	No. 258.	No. 261.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
22,510	1,000	0.	0.	0.	0.	.22	.11	.22	.20	.20	.22
112,550	5,000	.0130	0.	0.	0.	.47	.42	.49	.43	.50	
225,100	10.000	.0297		0.	0.	.82	.77	.83	.75	.85	.82
337,650	15,000	.0463		0.	0.	1.15	1.11	1.17	1.10	1.20	1.15
450,200	20,000	.0628		0.	0.	1.45	1.46	1.52	1.44	1.55	1.49
	1,000		.0005	0.	0.	.23	.14	.25	.22	.25	.22
472,710	21,000	.0668		0.	0.	1.52	1.55	1.61	1.50	1.68	1.55
495,220	22,000	.0719		0.	0.	1.64	1.68	1.70	1.55	1.78	1.65
517,730	23,000	.0783		0.	0.	1.78	1.87	1.85	1.61	1.81	1.81
540,240	24,000	.0847		0.	0.	1.90	2.04	1.96	1.69	1.88	1.94
562,750	25,000	.0924 .0944		0.	0.	2.00	2.22	2.10	1.75	1.96	2.22
	1,090		.0147			.58	.64	.51	.22	.32	.67
			.0110—	(Set after resting 16 hours.)		.56	.62	.48	.20	.28	.63
585,260	26,000	.0977 .1008		0.	0.	2.17	2.50	2.09	1.78	2.02	2.43
607,770	27,000	.1105 .1170		.08	0.	2.75	3.11	1.86	1.50	2.16	2.68
	1,000		.0309	.08	0.	1.84	1.88	.20		.35	1.02
607,770	27,000			.10 .70	Ultimate strength Sustained maximum stress while deflection increased to ″.70. Test then discontinued.						
	1,000			.01	.05						

Column failed by deflecting perpendicular to the plane of the web. Reduced ordinates of the Leuner strain diagrams, taken from the measured ordinates of the preceding tables.

LEUNER STRAIN RECORDERS LOCATED ON UPPER WEST FLANGE.

Applied loads per square inch.	Reduced ordinates.					
	0′ 11″.	4′ ¾″.	7′ 2½″.	10′ 4″.	13′ 5¾″.	16′ 7¼″.
	No. 258.	No. 257.	No. 256.	No. 255.	No. 252.	No. 261.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00158	.00175	.00167	.00179	.00194	.00162
1,000	0.	.00014	.00014	0.	0.	.00022
10,000	.00395	.00363	.00442	.00463	.00448	.00412
1,000	.00050	.00056	.00073	.00037	.00030	.00051
15,000	.00698	.00727	.00746	.00754	.00799	.00728
1,000	.00129	.00126	.00137	.00090	.00097	.00147
16,000	.00770	.00790	.00811	.00828	.00865	.00794
17,000	.00820	.00960	.00884	.00888	.00925	.00853
18,000	.00870	.00923	.00949	.00970	.01000	.00912
19,000	.00921	.00972	.01021	.01045	.01082	.00978
20,000	.00978	.01042	.01036	.01126	.01164	.01059
1,000	.00180	.00189	.00275	.00186	.00216	.00265

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON UPPER EDGE OF EAST FLANGE OF H SHAPE.

1,000	0.	0.	0.	0.	0.	0.
5,000	.00194	.00175	.00174	.00187	.00216	.00176
10,000	.00453	.00419	.00406	.00433	.00478	.00434
15,000	.00705	.00664	.00659	.00679	.00731	.00677
20,000	.00964	.00917	.00906	.00925	.00985	.00912
1,000	.00043	.00035	.00036	.00030	.00030	0.

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON LOWER EDGE OF EAST FLANGE OF H SHAPE.

Applied loads per square inch.	Reduced ordinates.					
	0′ 11″.	4′ ¾″.	7′ 2½″.	10′ 4″.	13′ 5¾″.	16′ 7½″.
	No. 258.	No. 257.	No. 256.	No, 255.	No. 252.	No. 261.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00187	.00189	.00145	.00157	.00202	.00162
10,000	.00431	.00441	.00384	.00388	.00455	.00412
15,000	.00683	.00692	.00630	.00619	.00716	.00647
20,000	.00928	.00944	.00877	.00851	.00970	.00904
1,000	.00014	.00021	.00022	.00030	.00015	.00007

THE SIX LEUNER STRAIN INSTRUMENTS MOUNTED ON LOWER EDGE OF WEST FLANGE OF H SHAPE.

1,000	0.	0.	0.	0.	0.	0.
5,000	.00223	.00210	.00152	.00201	.00194	.00154
10,000	.00468	.00447	.00391	.00455	.00455	.00412
15,000	.00719	.00685	.00645	.00701	.00708	.00654
20,000	.00950	.00983	.00892	.00955	.00955	.00897
1,000	.00007	.00021	.00007	.00022	.00015	.00015

Four Leuner instruments, Nos. 255, 252, 257, 256, at middle of length of column.

Nos. 258, 261, 4′ ¾″ from end.

Instruments at 4′ ¾″ from upper end.

Instruments at middle, or 8′ 9½″ from upper end to north end of gauged length of 400 millimeters.

LEUNER STRAIN RECORDERS.

Applied loads per square inch.	Reduced ordinates.					
	No. 255.	No. 252.	No. 257.	No. 256.	No. 258.	No. 261.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	0.	0.	0.	0.	0.
5,000	.00187	.00231	.00189	.00167	.00216	0.
10,000	.00448	.00493	.00426	.00398	.00468	.00441
15,000	.00694	.00746	.00664	.00652	.00719	.00684
20,000	.00918	.01007	.00909	.00899	.00971	.00934
1,000	.00007	.00022	.00021	.00015	.00036	0.
21,000	.00970	.01075	.00972	.00942	.01065	.00978
22,000	.01060	.01172	.01035	.00978	.01136	.01051
23,000	.01164	.01313	.01140	.01022	.01158	.01169
24,000	.01254	.01440	.01217	.01080	.01209	.01265
25,000	.01328	.01575	.01315	.01123	.01266	.01471
1,000	.00269	.00395	.00203	.00015	.00086	.00331
	.00254	.00381	.00182	0.	.00058	.00302
26,000	.01455	.01783	.01307	.01145	.01307	.01625
27,000	.01888	.02239	.01147	.00942	.01403	.01809
	.01208	.01321	.00014	(a)	.00108	.00588

[a] Pencil ran off paper.

LAP-WELDED STEEL TUBING.

No. 2086.

COMPRESSION TEST OF LAP-WELDED STEEL TUBING.

TESTED WITH FLAT ENDS.

Length of tubing, 18′ 7″.
Weight, 321 pounds.
Sectional area, 5.081 square inches.
Mean thickness, .35 inch.

Column adjusted in testing machine, after which transverse load at middle of 1,488 pounds was applied = 15,000 pounds per square inch fiber stress.

Transverse load caused a deflection of ″.44 when column was under 2,000 pounds compression.

Applied loads.		Deflection.	Remarks.
Total.	Per square inch.	Vertical.	
Pounds.	*Pounds.*	*Inches.*	
10,162	2,000	0.44	Initial load.
20,324	4,000	.22	
30,486	6,000	.18	
40,648	8,000	.17	
50,810	10,000	.18	
60,972	12,000	.17	
71,134	14,000	.20	
81,296	16,000	.21	
91,458	18,000	.21	
101,620	20,000	.23	
111,782	22,000	.28	
116,863	23,000	.36	
119,300	23,480	.66	Ultimate strength.
86,000	....	2.10	Ends leave full bearing.
84,500	Column gradually yielding under this load when transverse load of 1,488 pounds was removed.		
101,500	Maximum resistance of column after removal of transverse load. Test discontinued.		

No. 2087.

COMPRESSION TEST OF LAP-WELDED STEEL TUBING.

TESTED WITH PIN ENDS; PINS HORIZONTAL.

Length of tubing, 18′ 7″.
Length of column from center to center of pins, 19′ 2″.
Weight, 332 pounds.
Sectional area, 5.255 square inches.
Mean thickness, .36″.

Column adjusted in testing machine, after which transverse load at middle of 1,482 pounds was applied = 15,000 pounds per square inch fiber stress.

Transverse load caused a deflection of ″.84 when column was under 2,000 pounds compression.

Applied loads.		Deflection.	Remarks.
Total.	Per square inch.	Vertical.	
Pounds.	*Pounds.*	*Inches.*	
10,510	2,000	.84	Initial load.
21,020	4,000	.99	
31,530	6,000	1.22	
42,040	8,000	1.57	
48,200	9,172	2.21	Ultimate strength.
45,800	....	2.41	Load sustained with this deflection.
Load then reduced to 2,000 pounds per square inch compression.			
10,510	2,000	1.32	
Transverse load removed, allowing the column to spring back, increasing the compression load to 16,800 pounds total stress.			
10,510	2,000	.41	Deflection under initial load.
Loads were again increased as follows:			
21,020	4,000	.46	
31,530	6,000	.55	
42,040	8,000	.66	
52,550	10,000	.89	
63,060	12,000	1.44	
67,400	12,826	2.16	Maximum resistance.
The column was further bent, discontinuing the test when the load and deflection were as follows:			
38,000	....	5.29	
The column was removed from the testing machine, straightened cold, returned again and tested with pin ends as before but without the transverse load.			
When returned to the testing machine the strength was found to be—			
137,200	26,110	....	Ultimate strength.

PART V.

SECTION 2.

MISCELLANEOUS TESTS.

METAL FROM OPEN-HEARTH HEXAGONAL STEEL INGOT.

BARS FORGED DOWN IN THE DIRECTION OF THE LENGTH OF THE INGOT, AT DIFFERENT TEMPERATURES AND WITH DIFFERENT AMOUNTS OF REDUCTION. TENSILE TESTS.

No. 8658.

Marks, 13B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0019	....	
20,000	.0040	....	
30,000	.0061	....	
35,000	.0072	0.	
40,000	.0081	....	
45,000	.0091	0.	
50,000	.0101	.0002	
55,000	.0112	....	
60,000	.0123	....	
61,000	.0127	....	
62,000	.0130	....	
63,000	.0131	....	
64,000	.0132	....	Elastic limit.
65,000	.0830	....	
66,000	.0842	....	
67,000	.0865	....	
68,000	.0915	....	
69,000	.0950	....	
70,000	.10	....	
74,000	.12	....	
78,000	.14	....	
82,000	.17	....	
86,000	.20	....	
90,000	.23	....	
94,000	.27	....	
98,000	.33	....	
100,000	.36	....	
105,000	.52	....	
108,000	....	....	Tensile strength.
0	.88	....	=14.6 per cent elongation in 6″.

Elongation of inch sections, ″.09, ″.11, ″.13, ″.14, ″.25*, ″.16.
Diameter at fracture, ″.70; area, .385 square inch.
Contraction of area, 23 per cent.
Fractured 2″.20 from the neck.
Appearance of fracture, fine granular 85 per cent, silky 15 per cent.

No. 8645.

Marks, 13T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0019		
20,000	.0040		
30,000	.0060		
35,000	.0070	0.	
40,000	.0080		
45,000	.0091	0.	
50,000	.0101	0.	
55,000	.0110		
60,000	.0122		
65,000	.0134		
66,000	.0137		
67,000	.0140		Elastic limit.
68,000	.0828		
69,000	.0855		
70,000	.0900		
74,000	.10		
78,000	.13		
82,000	.15		
86,000	.18		
90,000	.21		
94,000	.24		
98,000	.29		
100,000	.32		
105,000	.43		
109,800			Tensile strength.
0	1.02		=17 per cent elongation in 6″.

Elongation of inch sections, ″.12, ″.15, ″.16, ″.21, ″.25*, ″.13.
Diameter at fracture, ″.69; area, .374 square inch.
Contraction of area, 25.2 per cent.
Fractured 2″.40 from the neck.
Appearance of fracture, fine granular 70 per cent, silky 30 per cent.

No. 8657.

Marks, 12B.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 6''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0010	0.	
10,000	.0020	....	
20,000	.0040	....	
30,000	.0060	....	
35,000	.0070	0.	
40,000	.0081	....	
45,000	.0091	.0002	
50,000	.0103	.0003	
55,000	.0117	....	
60,000	.0125	....	
65,000	.0135	....	
66,000	.0139	....	
67,000	.0140	....	
68,000	.0142	....	
69,000	.0147	....	
70,000	.0149	....	Elastic limit.
72,000	.02	....	
74,000	.10	....	
76,000	.11	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.18	....	
94,000	.22	....	
98,000	.26	....	
100,000	.28	....	
105,000	.37	....	
110,000	.55	....	
111,000	.62	....	
111,800	....	....	Tensile strength.
0	.97	....	=16.1 per cent elongation in 6''.

Elongation of inch sections, ''.11, ''.15, ''.14, ''.23, ''.25*, ''.09.
Diameter at fracture, ''.67; area, .353 square inch.
Contraction of area, 29.4 per cent.
Fractured 2''.40 from the neck.
Appearance of fracture, fine silky.

No. 8643.

Marks, 11T.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 6''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0018	....	
20,000	.0040	....	
30,000	.0060	....	
35,000	.0070	.0001	
40,000	.0081	....	
45,000	.0091	.0001	
50,000	.0102	.0002	
55,000	.0112	....	
60,000	.0122	....	
65,000	.0132	....	
66,000	.0135	....	
67,000	.0138	....	
68,000	.0140	....	
69,000	.0142	....	
70,000	.0145	....	
72,000	.02	....	Elastic limit.
74,000	.11	....	
76,000	.12	....	
78,000	.13	....	
82,000	.15	....	
86,000	.18	....	
90,000	.21	....	
94,000	.25	....	
98,000	.29	....	
100,000	.33	....	
105,000	.43	....	
110,000	....	....	Tensile strength.
0	.79	....	=13.1 per cent elongation in 6''.

Elongation of inch sections, ''.11, ''.12, ''.12, ''.13, ''.19*, ''.12.
Diameter at fracture, ''.72; area, .407 square inch.
Contraction of area, 18.6 per cent.
Fractured 2''.10 from the neck.
Appearance of fracture, fine granular 85 per cent, silky 15 per cent.

No. 8644.

Marks, 12T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0019	....	
20,000	.0041	....	
30,000	.0062	....	
35,000	.0071	0.	
40,000	.0081	....	
45,000	.0091	0.	
50,000	.0101	0.	
55,000	.0111	....	
60,000	.0121	....	
65,000	.0132	....	
69,000	.0141	....	
70,000	.0142	....	Elastic limit.
72,000	.10	....	
74,000	.11	....	
76,000	.12	....	
78,000	.13	....	
82,000	.14	....	
86,000	.17	....	
90,000	.20	....	
94,000	.23	....	
98,000	.27	....	
100,000	.30	....	
105,000	.39	....	
110,000	.58	....	
111,000	.72	....	
111,400	....	....	Tensile strength.
0	.96	....	=16 per cent elongation in 6″.

Elongation of inch sections, ″.11, ″.15, ″.13, ″.16, ″.29*, ″.12.
Diameter at fracture, ″.67; area, .353 square inch.
Contraction of area, 29.4 per cent.
Fractured 2″.10 from the neck.
Appearance of fracture, fine granular 60 per cent, silky 40 per cent.

No. 8648.

Marks, 3B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0019	....	
20,000	.0040	....	
30,000	.0062	....	
35,000	.0071	.0001	
40,000	.0082	....	
45,000	.0093	.0002	
50,000	.0103	.0004	
55,000	.0118	....	
56,000	.0121	....	Elastic limit.
57,000	.0403	....	
58,000	.0420	....	
59,000	.0448	....	
60,000	.0485	....	
61,000	0513	....	
62,000	.0555	....	
63,000	.0587	....	
64,000	.0640	....	
65,000	.0672	....	
70,000	.0860	....	
74,000	.11	....	
78,000	.13	....	
82,000	.16	....	
86,000	.18	....	
90,000	.21	....	
94,000	.25	....	
98,000	.30	....	
100,000	.32	....	
105,000	.44	....	Tensile strength.
0	.43	....	= 7.1 per cent elongation in 6″.

Elongation of inch sections, ″.07, ″.06, ″.08, ″.09*, ″.07, ″.06.
Diameter at fracture, ″.76; area, .454 square inch.
Contraction of area, 9.2 per cent.
Fractured 3″ from the neck.
Appearance of fracture, fine granular.

No. 8634.

Marks, 2T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009		
10,000	.0020		
20,000	.0041		
30,000	.0062		
35,000	.0072	0.	
40,000	.0082		
45,000	.0092	0.	
50,000	.0102		
51,000	.0106		
52,000	.0108		
53,000	.0110		Elastic limit.
54,000	.0119		
55,000	.0400		
56,000	.0403		
57,000	.0408		
58,000	.0415		
59,000	.0432		
60,000	.0460		
65,000	.0620		
70,000	.0830		
74,000	.10		
78,000	.12		
82,000	.15		
86,000	.17		
90,000	.20		
94,000	.23		
98,000	.28		
100,000	.30		
105,000	.40		
108,000			Tensile strength.
0	.55		= 9.1 per cent elongation in 6″.

Elongation of inch sections, ″.08, ″.09, ″.08, ″.13*, ″.10, ″.07.
Diameter at fracture, ″.75.
Area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 2″.80 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8646.

Marks, 1B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0018	....	
20,000	.0041	....	
30,000	.0061	....	
35,000	.0071	0.	
40,000	.0082	....	
45,000	.0091	.0001	
50,000	.0103	.0002	
55,000	.0113	....	
60,000	.0125	....	
61,000	.0128	....	Elastic limit.
62,000	.0340	....	
63,000	.0540	....	
64,000	.0620	....	
65,000	.0650	....	
70,000	.0855	....	
74,000	.10	....	
78,000	.12	....	
82,000	.15	....	
86,000	.17	....	
90,000	.20	....	
94,000	.23	....	
98,000	.27	....	
100,000	.30	....	
105,000	.40	....	
199,800	....	....	Tensile strength.
0	.79	....	=13.1 per cent elongation in 6″.

Elongation of inch sections, ″.10, ″.10, ″.10, ″.15, ″.21*, ″.13.
Diameter at fracture, ″.73; area, .419 square inch.
Contraction of area, 16.2 per cent.
Fractured 2″.50 from the neck.
Appearance of fracture, fine granular 85 per cent, silky 15 per cent.

No. 8647.

Marks, 2B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0020	....	
20,000	.0042	....	
30,000	.0062	....	
35,000	.0074	0.	
40,000	.0084	....	
45,000	.0095	.0002	
50,000	.0102	.0003	
55,000	.0115	....	
56,000	.0118	....	
57,000	.0120	....	
58,000	.0122	....	
59,000	.0128	....	
60,000	.0132	....	Elastic limit.
61,000	.0320	....	
62,000	.0533	....	
63,000	.0558	....	
64,000	.0597	....	
65,000	.0630	....	
66,000	.0675	....	
67,000	.0700	....	
68,000	.0742	....	
69,000	.0795	....	
70,000	.0830	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.19	....	
94,000	.22	....	
98,000	.26	....	
100,000	.29	....	
105,000	.38	....	
110,000	.66	....	
110,200	....	....	Tensile strength.
0	.76	....	=12.6 per cent elongation in 6″.

Elongation of inch sections, ″.11, ″.12, ″.11, ″.12 ″.14, ″.16*.
Diameter at fracture, ″.73; area, .419 square inch.
Contraction of area, 16.2 per cent.
Fractured 1″.20 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8633.

Marks, 1T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0020	....	
20,000	.0041	....	
30,000	.0062	....	
35,000	.0072	.0002	
40,000	.0083	....	
45,000	.0092	.0002	
50,000	.0104	.0003	
55,000	.0113	....	
59,000	.0122	....	
60,000	.0123	....	
65,000	.0137	....	
66,000	.0139	....	
67,000	.0141	....	
68,000	.0144	....	
69,000	.0147	....	Elastic limit.
70,000	.0830	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.19	....	
94,000	.22	....	
98,000	.26	....	
100,000	.28	....	
105,000	.36	....	
110,000	.53	....	
111,000	.58	....	
112,000	.68	....	
112,600	....	....	Tensile strength.
0	.93	....	=15.5 per cent elongation in 6″.

Elongation of inch sections, ″.14, ″.16, ″.16, ″.20*, ″.15, ″.12.
Diameter at fracture, ″.72.
Area, .407 square inch.
Contraction of area, 18.6 per cent.
Fractured 3″.80 from the neck.
Appearance of fracture; fine granular 85 per cent, silky 15 per cent.

No. 8637.

Marks, 5T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0018	....	
20,000	.0039	....	
30,000	.0059	....	
35,000	.0070	....	
40,000	.0080	....	
45,000	.0092	.0001	
46,000	.0096	....	
47,000	.0099	....	
48,000	.0102	....	
49,000	.0108	....	
50,000	.0112	.0011	Elastic limit.
51,000	.0124	....	
52,000	.0190	....	
53,000	.0235	....	
54,000	.0285	....	
55,000	.0320	....	
56,000	.0350	....	
57,000	.0390	....	
58 000	.0425	....	
59,000	.0457	....	
60,000	.0493	....	
65,000	.0675	....	
70,000	.0880	....	
74,000	.11	....	
78,000	.13	....	
82,000	.15	....	
86,000	.17	....	
90,000	.20	....	
94,000	.24	....	
98,000	.28	....	
100,000	.31	....	
104,800	....	....	Tensile strength.
0	.43	....	=7.2 per cent elongation in 6″.

Elongation of inch sections, ″.06, ″.07, ″.07, ″.09*, ″.07, ″.07.
Diameter at fracture, ″.76.
Area, .454 square inch.
Contraction of area, 9.2 per cent.
Fractured 3″.35 from the neck.
Appearance of fracture, fine granular.

No. 8636.

Marks, 4T.
Diameter, ".798.
Sectional area, .50 square inches.
Guaged length, 6".

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0011	0.	
10,000	.0020	....	
20,000	.0042	....	
30,000	.0067	....	
35,000	.0077	0.	
40,000	.0087	....	
45,000	.0099	.0003	
50,000	.0112	.0009	
51,000	.0118	....	
52,000	.0124	....	Elastic limit.
53,000	.0145	....	
54,000	.0220	....	
55,000	.0280	....	
56,000	.0318	....	
57,000	.0345	....	
58,000	.0400	....	
59,000	.0420	....	
60,000	.0450	....	
65,000	.0628	....	
70,000	.0840	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.19	....	
94,000	.22	....	
98,000	.26	....	
100,000	.29	....	
105,000	.37	....	
108,000	....	....	Tensile strength.
0	.46	....	=7.6 per cent elongation in 6".

Elongation of inch sections, ".06, ".07, ".08, ".10*, ".08, ".07.
Diameter at fracture, ".76.
Area, .454 square inch.
Contraction of area, 9.2 per cent.
Fractured at middle of stem.
Appearance of fracture, fine granular, silky spot near center.

No. 8650.

Marks, 5B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0019	....	
20,000	.0040	....	
30,000	.0060	....	
35,000	.0070	0.	
40,000	.0080	....	
45,000	.0091	0.	
50,000	.0102	0.	
51,000	.0108	....	Elastic limit.
52,000	.0128	....	
53,000	.0180	....	
54,000	.0260	....	
55,000	.0310	....	
56,000	.0348	....	
57,000	.0380	....	
58,000	.0420	....	
59,000	.0450	....	
60,000	.0495	....	
65,000	.0660	....	
70,000	.0855	....	
74,000	.11	....	
78,000	.13	....	
82,000	.15	....	
86,000	.17	....	
90,000	.20	....	
94,000	.23	....	
98,000	.27	....	
100,000	.30	....	
105,000	.40	....	
108,400	....	....	Tensile strength.
0	.57	....	= 9.5 per cent elongation in 6″.

Elongation of inch sections, ″.08, ″.10, ″.09, ″.09, ″.13*, ″.08.
Diameter at fracture, ″.75; area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 2″.10 from the neck.
Appearance of fracture, medium granular.

No. 8649.

Marks, 4B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009		
10,000	.0017		
20,000	.0037		
30,000	.0057		
35,000	.0069	0.	
40,000	.0080		
45,000	.0091	.0001	
50,000	.0101	.0002	
55,000	.0115		
56,000	.0118		
57,000	.0121		
58,000	.0127		
59,000	.0131		Elastic limit.
60,000	.0220		
61,000	.0270		
62,000	.0350		
63,000	.0400		
64,000	.0435		
65,000	.0475		
70,000	.0660		
74,000	.08		
78,000	.10		
82,000	.12		
86,000	.14		
90,000	.16		
94,000	.18		
98,000	.22		
100,000	.23		
105,000	.29		
110,000	.39		
111,000	.42		
112,000	.46		
113,000	.52		Tensile strength.
0	.52		=8.6 per cent elongation in 6″.

Elongation of inch sections, ″.09, ″.09, ″.09, ″.10*, ″.08, ″.07.
Diameter at fracture, ″.76; area, .454 square inch.
Contraction of area, 9.2 per cent.
Fractured 3″.10 from the neck.
Appearance of fracture, fine granular.

No. 8635.

Marks, 3T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	....	
10,000	.0020	....	
20,000	.0041	....	
30,000	.0062	....	
35,000	.0072	0.	
40,000	.0082	....	
45,000	.0092	.0001	
50,000	.0104	.0002	
55,000	.0114	....	
60,000	.0129	....	
61,000	.0131	....	
62,000	.0136	....	Elastic limit.
63,000	.0430	....	
64,000	.0528	....	
65,000	.0550	....	
66,000	.0580	....	
67,000	.0620	....	
68,000	.0655	....	
69,000	.0690	....	
70,000	.0730	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.18	....	
94,000	.20	....	
98,000	.24	....	
100,000	.26	....	
105,000	.33	....	
110,000	.46	....	
111,000	.50	....	
112,000	.58	....	
112,800	....	....	Tensile strength.
0	.68	....	= 11.3 per cent elongation in 6″.

Elongation of inch sections, ″.09, ″.10, ″.10, ″.11, ″.16*, ″.12.
Diameter at fracture, ″.74.
Area, .430 square inch.
Contraction of area, 14 per cent.
Fractured 2″.20 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8655.

Marks, 10B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0019	....	
20,000	.0040	....	
30,000	.0060	....	
35,000	.0072	0.	
40,000	.0081	....	
45,000	.0097	.0003	
46,000	.0100	....	
47,000	.0107	....	
48,000	.0110	....	Elastic limit.
49,000	.0122	....	
50,000	.0148	.0050	
51,000	.0178	....	
52,000	.0208	....	
53,000	.0242	....	
54,000	.0280	....	
55,000	.0318	....	
56,000	.0350	....	
57,000	.0388	....	
58,000	.0425	....	
59,000	.0463	....	
60,000	.0502	....	
65,000	.0685	....	
70,000	.0890	....	
74,000	.11	....	
78,000	.13	....	
82,000	.15	....	
86,000	.18	....	
90,000	.20	....	
94,000	.24	....	
98,000	.28	....	
100,000	.31	....	
105,000	.45	....	
105,800	....	....	Tensile strength.
0	.47	....	=7.8 per cent elongation in 6″.

Elongation of inch sections, ″.06, ″.09, ″.08, ″.09*, ″.08, ″.07.
Diameter at fracture, ″.76; area, .454 square inch.
Contraction of area, 9.2 per cent.
Fractured 3″.60 from the neck.
Appearance of fracture, fine granular.

No. 8656.

Marks, 11B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0019		
20,000	.0040		
30,000	.0060		
35,000	.0070	0.	
40,000	.0083		
45,000	.0098	.0005	
46,000	.0098		
47,000	.0100		
48,000	.0103		
49,000	.0109		Elastic limit.
50,000	.0120	.0017	
51,000	.0130		
52,000	.0180		
53,000	.0230		
54,000	.0278		
55,000	.0310		
56,000	.0350		
57,000	.0382		
58,000	.0425		
59,000	.0450		
60,000	.0495		
65,000	.0680		
70,000	.0890		
74,000	.11		
78,000	.13		
82,000	.15		
86,000	.18		
90,000	.20		
94,000	.24		
98,000	.28		
100,000	.31		
105,000	.43		
108,400			Tensile strength.
0	.72		=12 per cent elongation in 6″.

Elongation of inch sections, ″.11, ″.12, ″.11, ″.12, ″.16*, ″.10.
Diameter at fracture, ″.75; area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 2″.30 from the neck.
Appearance of fracture, fine granular, silky spot near center.

No. 8642.

Marks, 10T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10;000	.0020	....	
20,000	.0042	....	
30,000	.0063	....	
35,000	.0076	.0001	
40,000	.0084	....	
45,000	.0098	.0003	
46,000	.0100	....	
47,000	.0102	....	
48,000	.0108	....	
49,000	.0110	....	
50,000	.0118	.0017	Elastic limit.
51,000	.0130	....	
52,000	.0165	....	
53,000	.0210	....	
54,000	.0250	....	
55,000	.0280	....	
56,000	.0320	....	
57,000	.0360	....	
58,000	.0393	....	
59,000	.0432	....	
60,000	.0470	....	
65,000	.0642	....	
70,000	.0850	....	
74,000	.11	....	
78,000	.13	....	
82,000	.15	....	
86,000	.17	....	
90,000	.20	....	
94,000	.23	....	
98,000	.28	....	
100,000	.30	....	
105,000	.40	....	
108,400	....	....	Tensile strength.
0	.59	....	=9.8 per cent elongation in 6″.

Elongation of inch sections, ″.07, ″.09, ″.11, ″.14*, ″.10, ″.08.
Diameter at fracture, ″.75; area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 3″.70 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8654.

Marks, 9B.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 6''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0018	....	
20,000	.0040	....	
30,000	.0061	....	
35,000	.0072	0.	
40,000	.0084	....	
45,000	.0097	....	
46,000	.0100	....	
47,000	.0101	....	
48,000	.0103	....	
49,000	.0107	....	
50,000	.0110	....	
51,000	.0113	....	
52,000	.0118	....	Elastic limit.
53,000	.0155	....	
54,000	.0280	....	
55,000	.0362	....	
56,000	.0390	....	
57,000	.0425	....	
58,000	.0462	....	
59,000	.0500	....	
60,000	.0540	....	
65,000	.0720	....	
70,000	.0935	....	
74,000	.11	....	
78,000	.13	....	
82,000	.16	....	
86,000	.18	....	
90,000	.21	....	
94,000	.25	....	
98,000	.30	....	
100,000	.33	....	
105,000	.48	....	
108,200	....	....	Tensile strength.
0	.74	....	=12.3 per cent elongation in 6''.

Elongation of inch sections, ''.10, ''.12, ''.13, ''.11, ''.16*, ''.12.
Diameter at fracture, ''.74; area, .430 square inch.
Contraction of area, 14 per cent.
Fractured 2''.65 from the neck.
Appearance of fracture, fine granular, silky spot near circumference.

No. 8641.

Marks, 9T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0020	....	
20,000	.0040	....	
30,000	.0061	....	
35,000	.0070	.0001	
40,000	.0081	....	
45,000	.0092	.0002	
50,000	.0103	.0003	
52,000	.0108	....	
53,000	.0111	....	
54,000	.0120	....	
55,000	.0126	....	Elastic limit.
56,000	.0210	....	
57,000	.0310	....	
58,000	.0355	....	
59,000	.0382	....	
60,000	.0420	....	
65,000	.0610	....	
70,000	.0805	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.19	....	
94,000	.22	....	
98,000	.26	....	
100,000	.28	....	
105,000	.37	....	
110,000	.61	....	
110,400	....	....	Tensile strength.
0	.80	....	=13.3 per cent elongation in 6″.

Elongation of inch sections, ″.10, ″.12, ″.09, ″.16, ″.21*, ″.12.
Diameter at fracture, ″.73; area, .419 square inch.
Contraction of area, 16.2 per cent.
Fractured 2″.40 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8640.

Marks, 8T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0020	....	
20,000	.0041	....	
30,000	.0061	....	
35,000	.0072	.0001	
40,000	.0082	....	
45,000	.0091	.0001	
50,000	.0103	.0002	
55,000	.0117	....	
56,000	.0120	....	
57,000	.0126	....	Elastic limit.
58,000	.0280 .0350	....	
59,000	.0380	....	
60,000	.0410	....	
61,000	.0445	....	
62,000	.0485	....	
63,000	.0522	....	
64,000	.0558	....	
65,000	.0590	....	
70,000	.0785	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.18	....	
94,000	.21	....	
98,000	.25	....	
100,000	.27	....	
105,000	.36	....	
110,000	.54	....	
111,000	.66	....	
111,200	....	....	Tensile strength.
0	.84	....	—14 per cent elongation in 6″.

Elongation of inch sections, ″.09, ″.11, ″.13, ″.13, ″.15, ″.23*.
Diameter at fracture, ″.69; area, .374 square inch.
Contraction of area, 25.2 per cent.
Fractured 1″.65 from the neck.
Appearance of fracture, fine granular 85 per cent, silky 15 per cent.

No. 8638.

Marks, 6T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0009	0.	
10,000	.0020	....	
20,000	.0041	....	
30,000	.0062	....	
35,000	.0073	.0001	
40,000	.0086	....	
45,000	.0100	.0008	
46,000	.0103	....	
47,000	.0109	....	Elastic limit.
48,000	.0118	....	
49,000	.0130	....	
50,000	.0150	.0052	
51,000	.0175	....	
52,000	.0205	....	
53,000	.0232	....	
54,000	.0261	....	
55,000	.0300	....	
60,000	.0480	....	
65,000	.0668	....	
70,000	.0870	....	
74,000	.11	....	
78,000	.13	....	
82,000	.15	....	
86,000	.17	....	
90,000	.20	....	
94,000	.23	....	
98,000	.28	....	
100,000	.31	....	
105,000	.41	....	
108,400	....	....	Tensile strength.
0	.63	....	=10.5 per cent elongation in 6″.

Elongation of inch sections, ″.09, ″.11, ″.10, ″.13*, ″.11, ″.09.
Diameter at fracture, ″.75; area, .442 square inch.
Contraction of area, 11.6 per cent.
Fractured 2″.50 from the neck.
Appearance of fracture, fine granular.

No. 8653.

Marks, 8B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0010	0.	
10,000	.0020	....	
20,000	.0041	....	
30,000	.0062	....	
35,000	.0073	.0001	
40,000	.0085	....	
45,000	.0099	.0004	
46,000	.0100	....	
47,000	.0102	....	
48,000	.0107	....	
49,000	.0110	....	
50,000	.0117	.0010	
51,000	.0121	....	Elastic limit.
52,000	.0135	....	
53,000	.0168	....	
54,000	.0208	....	
55,000	.0245	....	
56,000	.0280	....	
57,000	.0318	....	
58,000	.0350	....	
59,000	.0385	....	
60,000	.0422	....	
65,000	.0605	....	
70,000	.0800	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.19	....	
94,000	.21	....	
98,000	.25	....	
100,000	.28	....	
105,000	.36	....	
110,000	.60	....	
110,600	....	....	Tensile strength.
0	.74	....	=12.3 per cent elogation in 6″.

Elongation of inch sections, ″.13, ″.13, ″.14, ″.15*, ″.12, ″.07.
Diameter at fracture, ″.74; area, .430 square inch.
Contraction of area, 14 per cent.
Fractured 2″.75 from the neck.
Appearance of fracture, fine granular, silky spot near circumference.

No. 8652.

Marks, 7B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0019	....	
20,000	.0040	....	
30,000	.0060	....	
35,000	.0071	0.	
40,000	.0081	....	
45,000	.0095	.0002	
46,000	.0098	....	
47,000	.0102	....	
48,000	.0106	....	
49,000	.0110	....	
50,000	.0118	.0017	Elastic limit.
51,000	.0130	....	
52,000	.0155	....	
53,000	.0210	....	
54,000	.0260	....	
55,000	.0285	....	
56,000	.0320	....	
57,000	.0360	....	
58,000	.0400	....	
59,000	.0430	....	
60,000	.0470	....	
65,000	.0635	....	
70,000	.0810	....	
74,000	.11	....	
78,000	.13	....	
82,000	.15	....	
86,000	.17	....	
90,000	.19	....	
94,000	.23	....	
98,000	.27	....	
100,000	.29	....	
105,000	.39	....	
109,800	....	....	Tensile strength.
0	.84	....	=14 per cent elongation in 6″.

Elongation of inch sections, ″.12, ″.12, ″.16, ″.21*, ″.14, ″.09.
Diameter at fracture, ″.70; area, .385 square inch.
Contraction of area, 23 per cent.
Fractured 3″.20 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8639.

Marks, 7T.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0018	....	
20,000	.0039	....	
30,000	.0058	....	
35,000	.0070	0.	
40,000	.0079	....	
45,000	.0090	0.	
50,000	.0101	0.	
51,000	.0103	....	Elastic limit.
52,000	.0112	....	
53,000	.0125	....	
54,000	.0190	....	
55,000	.0240	....	
56,000	.0292	....	
57,000	.0321	....	
58,000	.0355	....	
59,000	.0390	....	
60,000	.0430	....	
65,000	.0610	....	
70,000	.0800	....	
74,000	.10	....	
78,000	.12	....	
82,000	.14	....	
86,000	.16	....	
90,000	.19	....	
94,000	.22	....	
98,000	.26	....	
100,000	.28	....	
105,000	.36	....	
110,000	.55	....	
111,000	.67	....	Tensile strength.
0	.91	....	=15.1 per cent elongation in 6″.

Elongation of inch sections, ″.12, ″.14, ″.27*, ″.15, ″.14, ″.09.
Diameter at fracture, ″.68.
Area, .363 square inch.
Contraction of area, 27.4 per cent.
Fractured 3″.65 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8651.

Marks, 6B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0008	0.	
10,000	.0019		
20,000	.0040		
30,000	.0060		
35,000	.0070	0.	
40,000	.0080		
45,000	.0090	0.	
50,000	.0102	.0001	
51,000	.0106		
52,000	.0108		
53,000	.0112		
54,000	.0116		
55,000	.0120		Elastic limit.
56,000	.0128		
57,000	.0190		
58,000	.0270		
59,000	.0315		
60,000	.0355		
65,000	.0540		
70,000	.0720		
74,000	.09		
78,000	.11		
82,000	.13		
86,000	.15		
90,000	.17		
94,000	.20		
100,000	.25		
105,000	.32		
110,000	.44		
112,000	.54		
113,000	.70		
113,000			Tensile strength.
0	.96		=16 per cent elongation in 6″.

Elongation of inch sections, ″.11, ″.12, ″.14, ″.14, ″.30*, ″.15.
Diameter at fracture, ″.68; area, .363 square inch.
Contraction of area, 27.4 per cent.
Fractured 2″.10 from the neck.
Appearance of fracture, fine granular, silky center.

TABULATION OF TENSILE TESTS FROM OPEN-HEARTH HEXAGONAL STEEL INGOT.

Diameter of specimens, ″.798.
Sectional area, .50 square inch.
Gauged length, 6″.

No. of test.	Marks.	Reduction under hammer.	Approximate finishing temperature.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections.						Appearance of fracture.
		Per cent.	° *F.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*	″	″	″	″	″	″	
8658	13B......	6.0	1,400	64,000	108,000	14.6	23.0	.09	.11	.13	.14	.25*	.16	Fine granular 85 per cent, silky 15 per cent.
8645	13T......	9.2	1,400	67,000	109,800	17.0	25.2	.12	.15	.16	.21	.25*	.13	Fine granular 70 per cent, silky 30 per cent.
8657	12B......	16.1	1,400	70,000	111,800	16.1	29.4	.11	.15	.14	.23	.25*	.09	Fine silky.
8643	11T......	18.9	1,400	72,000	110,000	13.1	18.6	.11	.12	.12	.13	.19*	.12	Fine granular 85 per cent, silky 15 per cent.
8644	12T......	32.2	1,400	70,000	111,400	16.0	29.4	.11	.15	.13	.16	.29*	.12	Fine granular 60 per cent, silky 40 per cent.
8648	3B.......	2.3	1,600	56,000	105,000	7.1	9.2	.07	.06	.08	.09*	.07	.06	Fine granular.
8634	2T.......	7.2	1,600	53,000	108,000	9.1	11.6	.08	.09	.08	.13*	.10	.07	Fine granular 90 per cent, silky 10 per cent.
8646	1B.......	11.5	1,600	61,000	109,800	13.1	16.2	.10	.10	.10	.15	.21*	.13	Fine granular 85 per cent, silky 15 per cent.
8647	2B.......	27.2	1,600	60,000	110,200	12.6	16.2	.11	.12	.11	.12	.14	.16*	Fine granular 90 per cent, silky 10 per cent.
8633	1T.......	28.4	1,600	69,000	112,600	15.5	18.6	.14	.16	.16	.20*	.15	.12	Fine granular 85 per cent, silky 15 per cent.
8637	5T.......	2.5	1,800	50,000	104,800	7.2	9.2	.06	.07	.07	.09*	.07	.07	Fine granular.
8636	4T.......	5.6	1.800	52,000	108,000	7.6	9.2	.06	.07	.08	.10*	.08	.07	Fine granular, silky spot near center.
8650	5B.......	8.0	1.800	51,000	108,400	9.5	11.6	.08	.10	.09	.09	.13*	.08	Medium granular.
8649	4B.......	14.7	1,800	59,000	113,000	8.6	9.2	.09	.09	.09	.10*	.08	.07	Fine granular.
8635	3T.......	28.2	1,800	62,000	112,800	11.3	14.0	.09	.10	.10	.11	.16*	.12	Fine granular 90 per cent, silky 10 per cent.
8655	10B......	3.6	2,000	48,000	105,800	7.8	9.2	.06	.09	.08	.09*	.08	.07	Fine granular.
8656	11B......	6.1	2,000	49,000	108,400	12.0	11.6	.11	.12	.11	.12	.16*	.10	Fine granular, silky spot near center.
8642	10T......	10.3	2,000	50,000	108,400	9.8	11.6	.07	.09	.11	.14*	.10	.08	Fine granular 90 per cent, silky 10 per cent.
8654	9B.......	13.6	2,000	52,000	108,200	12.3	14.0	.10	.12	.13	.11	.16*	.12	Fine granular, silky spot near circumference.
8641	9T.......	26.5	2,000	55,000	110,400	13.3	16.2	.10	.12	.09	.16	.21*	.12	Fine granular 90 per cent, silky 10 per cent.
8640	8T.......	31.6	2,000	57,000	111,200	14.0	25.2	.09	.11	.13	.13	.15	.23*	Fine granular 85 per cent, silky 15 per cent.
8638	6T.......	4.3	2,200	47,000	108,400	10.5	11.6	.09	.11	.10	.13*	.11	.09	Fine granular.
8653	8B.......	14.5	2,200	51,000	110,600	12.3	14.0	.13	.13	.14	.15*	.12	.07	Fine granular, silky spot near circumference.
8652	7B.......	21.8	2,200	50,000	109,800	14.0	23.0	.12	.12	.16	.21*	.14	.09	Fine granular 90 per cent, silky 10 per cent.
8639	7T.......	27.0	2.200	51.000	111,000	15.1	27.4	.12	.14	.27*	.15	.14	.09	Fine granular, silky center.
8651	6B.......	29.6	2.200	55,000	113,000	16.0	27.4	.11	.12	.14	.14	.30*	.15	Do.

STEEL RAILS.

STEEL RAILS.

TENSILE TESTS OF SPECIMENS FROM HEADS OF RAILS.

Material contributed by Mr. R. Trimble, chief engineer of maintenance of way, Northwest System, Pennsylvania Lines, Pittsburg, Pa.

For transverse tests, see report of 1908, page 108.

No. 8741.

Marks, 96A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0062	....	
30,000	.0097	....	
35,000	.0113	....	
40,000	.0130	....	
45,000	.0150	0.	
50,000	.0172	.0001	
51,000	.0177	....	
52,000	.0182	....	Elastic limit.
53,000	.0196	....	
54,000	.0215	....	
55,000	.0265	.0089	
56,000	.0360	....	
57,000	.0450	....	
58,000	.0512	....	
59,000	.0580	....	
60,000	.0638	....	
65,000	.0950	....	
70,000	.1310	....	
74,000	.19	....	
78,000	.23	....	
82,000	.26	....	
86,000	.31	....	
90,000	.35	....	
94,000	.41	....	
98,000	.49	....	
100,000	.54	....	
105,000	.71	....	
110,000	....	....	Tensile strength.
0	1.34	....	=13.4 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.11, ″.14, ″.12, ″.12, ″.13, ″.14, ″.15, ″.21*, ″.12.
Diameter at fracture, ″.71; area, .396 square inch.
Contraction of area, 20.8 per cent.
Fractured 1″.95 from the neck.
Appearance of fracture, fine granular.

No. 8742.

Marks, 96B.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 10''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0064	....	
30,000	.0099	....	
35,000	.0117	0.	
40,000	.0133	....	
45,000	.0153	0.	
50,000	.0177	.0003	
51,000	.0182	....	
52,000	.0188	....	
53,000	.0193	....	Elastic limit.
54,000	.0218	....	
55,000	.0308	.0120	
56,000	.0400	....	
57,000	.0495	....	
58,000	.0568	....	
59,000	.0615	....	
60,000	.0670	....	
65,000	.0990	....	
70,000	.1350	....	
74,000	.18	....	
78,000	.22	....	
82,000	.26	....	
86,000	.30	....	
90,000	.36	....	
94,000	.42	....	
98,000	.50	....	
100,000	.54	....	
105,000	.74	....	
109,400	....	....	Tensile strength.
0	1.21	....	=12.1 per cent elongation in 10''.

Elongation of inch sections, ''.07, ''.09, ''.11, ''.12, ''11, ''.13, ''.14, ''.20*, ''.13, ''.11.
Diameter at fracture, ''.72; area, .407 square inch.
Contraction of area, 18.6 per cent.
Fractured 3''.30 from the neck.
Appearance of fracture, fine granular, silky spot in center.

No. 8743.

Marks, 97A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0062	....	
30,000	.0100	....	
35,000	.0119	.0005	
40,000	.0146	....	
41,000	.0153	....	
42,000	.0162	....	
43,000	.0170	....	
44,000	.0180	....	Elastic limit.
45,000	.0198	.0048	
46,000	.0230	....	
47,000	.0310	....	
48,000	.0390	....	
49,000	.0480	....	
50,000	.0535	....	
51,000	.0572	....	
52,000	.0620	....	
53,000	.0700	....	
54,000	.0770	....	
55,000	.0860	....	
60,000	.1240	....	
65,000	.1640	....	
70,000	.2150	....	
74,000	.27	....	
78,000	.33	....	
82,000	.40	....	
86,000	.48	....	
90,000	.59	....	
92,000	.68	....	
94,000	.81	....	
96,000	.98	....	
98,000	....	....	Tensile strength.
0	1.81	....	=18.1 per cent elongation in 10″.

Elongation of inch sections, ″.12, ″.15, ″.16, ″.17, ″.19, ″.21, ″.35*, ″.19, ″.14, ″.13.

Diameter at fracture, ″.69; area, .374 square inch.

Contraction of area, 25.2 per cent.

Fractured 1″.35 from the neck.

Appearance of fracture, fine granular, silky center.

No. 8749.

Marks, 97B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0013	0.	
10,000	.0030		
20,000	.0065		
30,000	.0101		
35,000	.0120	0.	
40,000	.0141		
43,000	.0153		
44,000	.0160		
45,000	.0170	.0010	
46,000	.0180		Elastic limit.
47,000	.0250		
48,000	.0390		
49,000	.0500		
50,000	.0560		
51,000	.0610		
52,000	.0670		
53,000	.0750		
54,000	.0820		
55,000	.0898		
60,000	.1290		
65,000	.1710		
70,000	.2220		
74,000	.28		
78,000	.33		
82,000	.39		
86,000	.48		
90,000	.60		
94,000	.82		
96,000	.98		
98,000			Tensile strength.
0	1.64		=16.4 per cent elongation in 10″.

Elongation of inch sections, ″.09, ″.11, ″.12, ″.14, ″.19, ″.28*, ″.26, ″.18, ″.15, ″.12.
Diameter at fracture, ″.65; area, .332 square inch.
Contraction of area, 33.6 per cent.
Fractured 4″.85 from the neck.
Appearance of fracture, fine granular 90 per cent, silky 10 per cent.

No. 8750.

Marks, 98A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0061	....	
30,000	.0098	....	
35,000	.0117	0.	
40,000	.0133	....	
45,000	.0152	0.	
50,000	.0168	0.	
51,000	.0171	....	
52,000	.0177	....	
53,000	.0182	....	
54,000	.0187	....	
55,000	.0197	....	
56,000	.0200	....	Elastic limit.
57,000	.0217	....	
58,000	.0240	....	
59,000	.0380	....	
60,000	.0460	....	
61,000	.0607	....	
62,000	.0625	....	
63,000	.0660	....	
64,000	.0720	....	
65,000	.0780	....	
70,000	.1090	....	
74,000	.16	....	
78,000	.19	....	
82,000	.21	....	
86,000	.25	....	
90,000	.29	....	
94,000	.33	....	
98,000	.37	....	
100,000	.40	....	
105,000	.50	....	
110,000	.69	....	
111,000	.70	....	
112,000	.77	....	
113,000	.80	....	
113,800	....	....	Tensile strength.
0	.80	....	=8 per cent elongation in 10″.

Elongation of inch sections, ″.08, ″.08, ″.08, ″.09, ″.08*, ″.09, ″.08, ″.08, ″.07, ″.07.

Diameter at fracture, ″.76; area, .454 square inch.

Contraction of area, 9.2 per cent.

Fractured at middle of stem.

Appearance of fracture, fine granular.

No. 8751.

Marks, 98B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0013	0.	
10,000	.0028	....	
20,000	.0062	....	
30,000	.0099	....	
35,000	.0117	.0001	
52,000	.0220	....	
53,000	.0227	....	
54,000	.0231	....	Elastic limit, approximate.
55,000	.0242	....	
56,000	.0267	....	
57,000	.0290	....	
58,000	.0340	....	
59,000	.0420	....	
60,000	.0520	....	
65,000	.0840	....	
70,000	.1150	....	
74,000	.16	....	
78,000	.19	....	
82,000	.22	....	
86,000	.25	....	
90,000	.29	....	
94,000	.33	....	
98,000	.38	....	
103,200	....	....	Tensile strength.
0	.41	....	=4.1 per cent elongation in 10″.

Elongation of inch sections, ″.04, ″.04, ″.04, ″.04, ″.04, ″.04, ″.06*, ″.04, ″.03, ″.04.

Diameter at fracture, ″.77; area, .466 square inch.
Contraction of area, 6.8 per cent.
Fractured 3″.65 from the neck.
Appearance of fracture, fine granular.

No. 8752.

Marks, 99A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0065	....	
30,000	.0102	....	
35,000	.0127	.0009	
38,000	.0145	....	
39,000	.0150	....	
40,000	.0160	....	
41,000	.0171	....	
42,000	.0180	....	Elastic limit.
43,000	.0195	....	
44,000	.0212	....	
45,000	.0240	.0085	
46,000	.0310	....	
47,000	.0350	....	
48,000	.0410	....	
49,000	.0480	....	
50,000	.0550	....	
55,000	.0910	....	
60,000	.1350	....	
65,000	.1870	....	
70,000	.2430	....	
74,000	.33	....	
78,000	.39	....	
82,000	.48	....	
86,000	.61	....	
88,000	.71	....	
90,000	.82	....	
92,000	1.04	....	
93,600	....	....	Tensile strength.
0	1.64	....	=16.4 per cent elongation in 10″.

Elongation of inch sections, ″.11, ″.13, ″.14, ″.17, ″.16, ″.25*, ″.25, ″.15, ″.15, ″.13.

Diameter at fracture, ″.68; area, .363 square inch.

Contraction of area, 27.4 per cent.

Fractured 4″.90 from the neck.

Appearance of fracture, fine granular, silky spot near circumference, opened seam on side of stem at silky spot.

No. 8753.

Marks, 99B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030		
20,000	.0063		
30,000	.0100		
35,000	.0122	.0008	
38,000	.0139		
39,000	.0143		
40,000	.0159		Elastic limit.
41,000	.0180		
42,000	.0198		
43,000	.0220		
44,000	.0270		
45,000	.0310	.0160	
46,000	.0391		
47,000	.0457		
48,000	.0470		
49,000	.0520		
50,000	.0590		
51,000	.0655		
52,000	.0715		
53,000	.0800		
54,000	.0900		
55,000	.0990		
60,000	.1440		
65,000	.1980		
70,000	.2590		
74,000	.35		
78,000	.41		
82,000	.50		
86,000	.67		
88,000	.77		
90,000	.93		
92,000	1.29		
92,200			Tensile strength.
	1.71		=17.1 per cent elongation in 10″.

Elongation of inch sections, ″.11, ″.11, ″.13, ″.15, ″.18, ″.18, ″.23, ″.32*, ″.19, ″.11.
Diameter at fracture, ″.67; area, .353 square inch.
Contraction of area, 29.4 per cent.
Fractured 3″.45 from the neck.
Appearance of fracture, fine granular 85 per cent, silky 15 per cent.

No. 8754.

Marks, 100A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0011	0.	
10,000	.0027	....	
20,000	.0060	....	
30,000	.0098	....	
35,000	.0113	0.	
40,000	.0133	....	
45,000	.0154	....	
46,000	.0156	....	
47,000	.0160	....	
48,000	.0163	....	Elastic limit
49,000	.0218	....	
50,000	.0450	....	
51,000	.0550	....	
52,000	.0630	....	
53,000	.0680	....	
54,000	.0740	....	
55,000	.0810	....	
60,000	.1170	....	
65,000	.1580	....	
70,000	.2030	....	
74,000	.26	....	
78,000	.31	....	
82,000	.37	....	
86,000	.43	....	
90,000	.53	....	
94,000	.67	....	
96,000	.77	....	
98,000	.93	....	
100,000	1.40	....	Tensile strength.
0	1.81	....	=18.1 per cent elongation in 10″.

Elongation of inch sections, ″.13, ″.17, ″.16, ″.16, ″.18, ″.24, ″.36*, ″.18, ″.13, ″.10.

Diameter at fracture, ″.64; area, .322 square inch.

Contraction of area, 35.6 per cent.

Fractured 4″.50 from the neck.

Appearance of fracture, fine granular, silky center.

No. 8755.

Marks, 100B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0013	0.	
10,000	.0031	....	
20,000	.0068	....	
30,000	.0101	....	
35,000	.0120	0.	
40,000	.0135	....	
45,000	.0160	....	
46,000	.0165	....	Elastic limit.
47,000	.0178	....	
48,000	.0192	....	
49,000	.0440	....	
50,000	.0540	....	
51,000	.0610	....	
52,000	.0670	....	
53,000	.0715	....	
54,000	.0780	....	
55,000	.0840	....	
60,000	.1200	....	
65,000	.1635	....	
70,000	.2110	....	
74,000	.26	....	
78,000	.31	....	
82,000	.37	....	
86,000	.43	....	
90,000	.53	....	
94,000	.68	....	
96,000	.77	....	
98,000	.94	....	
100,000	1.30	....	Tensile strength.
0	1.68	....	=16.8 per cent elongation in 10″.

Elongation of inch sections, ″.12, ″.13, ″.14, ″.14, ″.14, ″.15, ″.19, ″.36,* ″.17, ″.14.
Diameter at fracture, ″.64; area, .322 square inch.
Contraction of area, 35.6 per cent.
Fractured 3″.10 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8756.

Marks, 101A.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 10''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0067	....	
30,000	.0100	....	
35,000	.0120	0.	
40,000	.0136	....	
46,000	.0158	....	
47,000	.0162	....	
48,000	.0167	....	
49,000	.0175	....	
50,000	.0183	....	Elastic limit.
51,000	.0198	....	
52,000	.0230	....	
53,000	.0350	....	
54,000	.0430	....	
55,000	.0470	....	
56,000	.0520	....	
57,000	.0570	....	
58,000	.0630	....	
59,000	.0700	....	
60,000	.0780	....	
65,000	.1170	....	
70,000	.1560	....	
74,000	.21	....	
78,000	.25	....	
82,000	.30	....	
86,000	.34	....	
90,000	.41	....	
94,000	.50	....	
98,000	.61	....	
100,000	.70	....	
104,600	....	....	Tensile strength.
0	1.48	....	= 14.8 per cent elongation in 10''.

Elongation of inch sections, ''.10, ''.11, ''.15, ''.16, ''.13, ''.12, ''.11, '',15, ''.30,* ''.15.

Diameter at fracture, ''.67; area, .353 square inch.

Contraction of area, 29.4 per cent.

Fractured 1''.90 from the neck.

Appearance of fracture, fine granular, silky center.

No. 8757.

Marks, 101B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0062	....	
30,000	.0099	....	
35,000	.0118	....	
40,000	.0136	....	
45,000	.0158	....	
47,000	.0164	....	
48,000	.0171	....	
49,000	.0178	....	Elastic limit.
50,000	.0190	....	
51,000	.0250	....	
52,000	.0450	....	
53,000	.0520	....	
54,000	.0590	....	
55,000	.0630	....	
60,000	.0990	....	
65,000	.1330	....	
70,000	.1750	....	
74,000	.22	....	
78,000	.26	....	
82,000	.32	....	
86,000	.37	....	
90,000	.43	....	
94,000	.53	....	
98,000	.65	....	
100,000	.77	....	
104,000	....	....	Tensile strength.
0	1.76	....	=17.6 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.13, ″.14, ″.17, ″.17, ″.27*, ″.27, ″.20, ″.17, ″.14.
Diameter at fracture, ″.67; area, .353 square inch.
Contraction of area, 29.4 per cent.
Fractured 4″.85 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8758.

Marks, 102A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0029	....	
20,000	.0062	....	
30,000	.0101	....	
35,000	.0118	0.	
40,000	.0139	....	
44,000	.0161	....	
45,000	.0169	.0017	
46,000	.0178	....	Elastic limit.
47,000	.0200	....	
48,000	.0235	....	
49,000	.0390	....	
50,000	.0490	....	
51,000	.0570	....	
52,000	.0640	....	
53,000	.0720	....	
54,000	.0790	....	
55,000	.0850	....	
60,000	.1250	....	
65,000	.1690	....	
70,000	.2200	....	
74,000	.28	....	
78,000	.34	....	
82,000	.41	....	
86,000	.51	....	
90,000	.62	....	
92,000	.71	....	
94,000	.88	....	
96,000	1.06	....	
97,400	....	....	Tensile strength.
0	1.78	....	=17.8 per cent elongation in 10″.

Elongation of inch sections, ″.11, ″.11, ″.13, ″.15, ″.18, ″.27, ″.36*, ″.19, ″.15, ″.13.

Diameter at fracture, ″.62; area, .302 square inch.

Contraction of area, 39.6 per cent.

Fractured 4″.70 from the neck.

Appearance of fracture, silky.

No. 8759.

Marks, 102B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030	...	
20,000	.0065	...	
30,000	.0100	...	
35,000	.0120	.0001	
40,000	.0138	...	
45,000	.0168	...	
46,000	.0173	...	Elastic limit.
47,000	.0212	...	
48,000	.0260	...	
49,000	.0450	...	
50,000	.0550	...	
51,000	.0595	...	
52,000	.0650	...	
53,000	.0710	...	
54,000	.0810	...	
55,000	.0880	...	
60,000	.1270	...	
65,000	.1720	...	
70,000	.2220	...	
74,000	.28	...	
78,000	.34	...	
82,000	.41	...	
86,000	.50	...	
90,000	.64	...	
92,000	.73	...	
94,000	.87	...	
96,000	1.16	...	
97,000	...	...	Tensile strength.
0	1.77	...	=17.7 per cent elongation in 10″.

Elongation of inch sections, ″.11, ″.13, ″.15, ″.17, ″.17, ″.19, ″.36*, ″.22, ″.14, ″.13.

Diameter at fracture, ″.62; area, .302 square inch.

Contraction of area, 39.6 per cent.

Fractured 3″.80 from the neck.

Appearance of fracture, silky.

No. 8760.

Marks, 103A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0063	....	
30,000	.0100	....	
35,000	.0117	0.	
40,000	.0134	....	
45,000	.0152	.0001	
50,000	.0173	.0005	
51,000	.0180	....	
52,000	.0185	....	
53,000	.0198	....	
54,000	.0201	....	
55,000	.0208	.0020	
56,000	.0213	....	Elastic limit.
57,000	.0225	....	
58,000	.0250	....	
59,000	.0300	....	
60,000	.0370	....	
65,000	.0660	....	
70,000	.0940	....	
74,000	.14	....	
78,000	.16	....	
82,000	.19	....	
86,000	.22	....	
90,000	.26	....	
94,000	.29	....	
98,000	.33	....	
100,000	.36	....	
105,000	.43	....	
110,000	.55	....	
115,000	.75	....	
116,000	.82	....	
117,000	.95	....	
118,000	....	....	Tensile strength.
0	1.26	....	=12.6 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.10, ″.10, ″.11, ″.12, ″.21*, ″.19, ″.12, ″.12, ″.09.
Diameter at fracture, ″.69; area, .374 square inch.
Contraction of area, 25.2 per cent.
Fractured 4″.65 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8761.

Marks, 103B.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 10''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030	....	
20,000	.0062	....	
30,000	.0100	....	
35,000	.0118	0.	
40,000	.0133	....	
45,000	.0152	.0001	
46,000	.0157	....	
47,000	.0161	....	
48,000	.0165	....	
49,000	.0170	....	
50,000	.0173	.0008	
51,000	.0181	....	Elastic limit.
52,000	.0231	....	
53,000	.0235	....	
54,000	.0238	....	
55,000	.0242	....	
56,000	.0245	....	
57,000	.0251	....	
58,000	.0268	....	
59,000	.0300	....	
60,000	.0345	....	
65,000	.0640	....	
70,000	.0940	....	
74,000	.13	....	
78,000	.16	....	
82,000	.19	....	
86,000	.22	....	
90,000	.26	....	
94,000	.30	....	
98,000	.34	....	
100,000	.36	....	
105,000	.45	....	
110,000	.55	....	
115,000	.78	....	
116,000	.84	....	
117,000	.98	....	
118,000	....	....	Tensile strength.
0	1.31	....	=13.1 per cent elongation in 10''.

Elongation of inch sections, ''.09, ''.11, ''.13, ''.15, ''.14, ''.16, ''.24*, ''.11, ''.10, ''.08.

Diameter at fracture, ''.69; area, .374 square inch.

Contraction of area, 25.2 per cent.

Fractured 4''.35 from the neck.

Appearance of fracture, fine granular, silky center.

No. 8762.

Marks, 104A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10.″

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0029	....	
20,000	.0062	....	
30,000	.0100	....	
35,000	.0119	0.	
40,000	.0137	....	
45,000	.0158	....	
50,000	.0178	....	
51,000	.0182	....	
52,000	.0188	....	
53,000	.0195	....	
54,000	.0202	....	
55,000	.0212	....	
56,000	.0217	....	Elastic limit, approximate.
57,000	.0230	....	
58,000	.0250	....	
59,000	.0275	....	
60,000	.0310	....	
61,000	.0360	....	
62,000	.0430	....	
63,000	.0490	....	
64,000	.0550	....	
65,000	.0610	....	
70,000	.0940	....	
74,000	.14	....	
78,000	.16	....	
82,000	.20	....	
86,000	.24	....	
90,000	.28	....	
94,000	.31	....	
98,000	.36	....	
100,000	.40	....	
105,000	.50	....	
110,000	.64	....	
113,000	.82	....	
114,000	.94	....	
114,800	....	....	Tensile strength.
0	1.40	....	=14 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.11, ″.13, ″.15, ″.13, ″.14, ″.27*, ″.16, ″.11, ″.10.
Diameter at fracture, ″.68; area, .363 square inch.
Contraction of area, 27.4 per cent.
Fractured 3″.90 from the neck.
Appearance, fine granular, silky center.

No. 8763.

Marks, 104B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0030		
20,000	.0063		
30,000	.0101		
35,000	.0120	.0001	
45,000	.0165	.0012	
50,000	.0192	.0021	
51,000	.0199		
52,000	.0204		Elastic limit.
53,000	.0217		
54,000	.0227		
55,000	.0240	.0051	
56,000	.0250		
57,000	.0263		
58,000	.0290		
59,000	.0335		
60,000	.0360		
65,000	.0685		
70,000	.1010		
74,000	.14		
78,000	.17		
82,000	.21		
86,000	.25		
90,000	.28		
94,000	.32		
98,000	.38		
100,000	.41		
105,000	.51		
110,000	.68		
113,000	.84		
114,000	1.00		
114,800			Tensile strength.
0	1.43		=14.3 per cent elongation in 10″.

Elongation of inch sections, ″.09, ″.11, ″.13, ″.14, ″.17, ″.30*, ″.16, ″.13, ″.11, ″.09.
Diameter at fracture, ″.68; area, .363 square inch.
Contraction of area, 27.4 per cent.
Position of fracture 5.30 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8764.

Marks, 105A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0061	....	
30,000	.0099	....	
35,000	.0117	0.	
40,000	.0134	....	
45,000	.0151	0.	
50,000	.0170	....	
52,000	.0175	....	
53,000	.0180	....	
54,000	.0187	....	
55,000	.0192	....	
56,000	.0198	....	Elastic limit.
57,000	.0220	....	
58,000	.0380	....	
59,000	.0500	....	
60,000	.0580	....	
65,000	.0910	....	
70,000	.1320	....	
74,000	.18	....	
78,000	.21	....	
82,000	.25	....	
86,000	.30	....	
90,000	.34	....	
94,000	.39	....	
98,000	.48	....	
105,000	.70	....	
109,800	....	....	Tensile strength.
0	1.57	....	=15.7 per cent elongation in 10″.

Elongation of inch sections, ″.11, ″.12, ″.16, ″.15, ″.35*, ″.16, ″.14, ″.12, ″.10.
Diameter at fracture, ″.65; area, .332 square inch.
Contraction of area, 33.6 per cent.
Fractured 5.50 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8765.

Marks, 105B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0062	....	
30,000	.0099	....	
35,000	.0117	0.	
40,000	.0134	....	
45,000	.0153	.0002	
50,000	.0173	.0006	
51,000	.0178	....	
52,000	.0182	....	
53,000	.0188	....	
54,000	.0200	....	
55,000	.0204	.0021	
56,000	.0212	....	Elastic limit.
57,000	.0250	....	
58,000	.0400	....	
59,000	.0520	....	
60,000	.0610	....	
65,000	.0945	....	
70,000	.1320	....	
74,000	.18	....	
78,000	.21	....	
82,000	.25	....	
86,000	.29	....	
90,000	.34	....	
94,000	.40	....	
98,000	.47	....	
105,000	.71	....	
109,600	....	....	Tensile strength.
0	1.47	....	= 14.7 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.11, ″.11, ″.13, ″.15, ″.31*, ″.16, ″.15, ″.14, ″.11.

Diameter at fracture, ″.65; area, .332 square inch.

Contraction of area, 33.6 per cent.

Fractured 5.15 from the neck.

Appearance of fracture, fine granular, silky center.

No. 8766.

Marks, 106A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0029		
20,000	.0062		
30,000	.0099		
35,000	.0118	0.	
40,000	.0136		
45,000	.0158		
47,000	.0163		
48,000	.0171		Elastic limit.
49,000	.0182		
50,000	.0195	.0030	
51,000	.0330		
52,000	.0480		
53,000	.0570		
54,000	.0610		
55,000	.0670		
60,000	.1030		
65,000	.1420		
70,000	.1820		
74,000	.23		
78,000	.28		
82,000	.32		
86,000	.38		
90,000	.47		
94,000	.58		
98,000	.73		
100,000	.88		
102,800			Tensile strength.
0	1.75		=17.5 per cent elongation in 10″.

Elongation of inch sections, ″.12, ″.12, ″.15, ″.17, ″.29, ″.28*, ″.17, ″.18, ″.15, ″.12.
Diameter at fracture ″.64; area, .322 square inch.
Contraction of area, 35.6 per cent.
Fractured at middle of stem.
Appearance of fracture, silky with trace of granulation.

No. 8767.

Marks, 106B.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 10''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0029	....	
20,000	.0063	....	
30,000	.0100	....	
35,000	.0118	0.	
40,000	.0135	....	
45,000	.0156	....	
46,000	.0159	....	
47,000	.0163	....	
48,000	.0170	....	
49,000	.0180	....	Elastic limit.
50,000	.0230	.0073	
51,000	.0310	....	
52,000	.0390	....	
53,000	.0450	....	
54,000	.0500	....	
55,000	.0550	....	
60,000	.0840	....	
65,000	.1300	....	
70,000	.1750	....	
74,000	.22	....	
78,000	.27	....	
82,000	.31	....	
86,000	.38	....	
90,000	.46	....	
94,000	.58	....	
98,000	.77	....	
100,000	.98	....	
102,000	....	....	Tensile strength.
0	1.57	....	=15.7 per cent elongation in 10''.

Elongation of inch sections, ''.11, ''.13, ''.15, ''.18, ''.27*, ''.29*, ''.14, ''.11, ''.09, ''.10.
Diameter at fracture, ''.63; area, .312 square inch.
Contraction of area, 37.6 per cent.
Fractured at middle of stem.
Appearance of fracture, silky.

No. 8768.

Marks, 107A.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0012	0.	
10,000	.0028	....	
20,000	.0063	....	
30,000	.0100	....	
35,000	.0118	0.	
40,000	.0137	....	
45,000	.0158	....	
50,000	.0188	....	Elastic limit, approximate.
51,000	.0200	....	
52,000	.0210	....	
53,000	.0220	....	
54,000	.0260	....	
55,000	.0310	....	
56,000	.0400	....	
57,000	.0480	....	
58,000	.0548	....	
59,000	.0610	....	
60,000	.0660	....	
65,000	.1040	....	
70,000	.1390	....	
74,000	.19	....	
78,000	.23	....	
82,000	.27	....	
86,000	.32	....	
90,000	.38	....	
94,000	.45	....	
98,000	.54	....	
100,000	.60	....	
105,000	.92	....	
107,200	....	....	Tensile strength.
0	1.55	....	=15.5 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.11, ″.13, ″.13, ″.15, ″.21, ″.31*, ″.16, ″.13, ″.12.
Diameter at fracture, ″.66; area, .342 square inch.
Contraction of area, 31.6 per cent.
Fractured 4″.50 from the neck.
Appearance of fracture, fine granular, silky center.

No. 8769.

Marks, 107B.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0013	0.	
10,000	.0030		
20,000	.0065		
30,000	.0101		
35,000	.0119	0.	
40,000	.0138		
45,000	.0160		
50,000	.0185		
51,000	.0190		Elastic limit, approximate.
52,000	.0200		
53,000	.0227		
54,000	.0300		
55,000	.0360		
56,000	.0440		
57,000	.0510		
58,000	.0590		
59,000	.0670		
60,000	.0735		
65,000	.1060		
70,000	.1450		
74,000	.19		
78,000	.23		
82,000	.27		
86,000	.32		
90,000	.38		
94,000	.46		
98,000	.57		
100,000	.63		
105,000	.98		
106,200			Tensile strength.
0	1.42		=14.2 per cent elongation in 10″.

Elongation of inch sections, ″.10, ″.12, ″.14, ″.15, ″.19, ″.28*, ″.12, ″.13, ″.11, ″.08.
Diameter at fracture, ″.67; area, .353 square inch.
Contraction of area, 29.4 per cent.
Fractured 5.50 from the neck.
Appearance of fracture, fine granular, silky center.

TABULATION OF TENSILE TESTS OF STEEL RAILS.

HEADS OF RAILS.

Diameter of specimens, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

No. of test.	Marks.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections.										Appearance of fracture.
		Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	″	″	″	″	″	″	″	″	″	″	
8741	96A..........	52,000	110,000	13.4	20.8	.10	.11	.14	.12	.12	.13	.14	.15	.21*	.12	Fine granular.
8742	96B..........	53,000	109,400	12.1	18.6	.07	.09	.11	.12	.11	.13	.14	.20*	.13	.11	Fine granular, silky spot in center.
8743	97A..........	44,000	98,000	18.1	25.2	.12	.15	.16	.17	.19	.21	.35*	.19	.14	.13	Fine granular, silky center.
8749	97B..........	46,000	98,000	16.4	33.6	.09	.11	.12	.14	.19	.28*	.26	.18	.15	.12	Fine granular 90 per cent, silky 10 per cent.
8750	98A..........	56,000	113,800	8.0	9.2	.08	.08	.08	.09	.08*	.09	.08	.08	.07	.07	Fine granular.
8751	98B..........	54,000	103,200	4.1	6.8	.04	.04	.04	.04	.04	.04	.06*	.04	.03	.04	Do.
8752	99A..........	42,000	93,600	16.4	27.4	.11	.13	.14	.17	.16	.25*	.25	.15	.15	.13	Fine granular, silky spot near circumference.
8753	99B..........	40,000	92,200	17.1	29.4	.11	.11	.13	.15	.18	.18	.23	.32*	.19	.11	Fine granular 85 per cent, silky 15 per cent.
8754	100A..........	48,000	100,000	18.1	35.6	.13	.17	.16	.16	.18	.24	.36*	.18	.13	.10	Fine granular, silky center.
8755	100B..........	46,000	100,000	16.8	35.6	.12	.13	.14	.14	.14	.15	.19	.36*	.17	.14	Do.
8756	101A..........	50,000	104,600	14.8	29.4	.10	.11	.15	.16	.13	.12	.11	.15	.30*	.15	Do.
8757	101B..........	49,000	104,000	17.6	29.4	.10	.13	.14	.17	.17	.27*	.27	.20	.17	.14	Do.
8758	102A..........	46,000	97,400	17.8	39.6	.11	.11	.13	.15	.18	.27	.36*	.19	.15	.13	Silky.
8759	102B..........	46,000	97,000	17.7	39.6	.11	.13	.15	.17	.17	.19	.36*	.22	.14	.13	Do.
8760	103A..........	56,000	118,000	12.6	25.2	.10	.10	.10	.11	.12	.21*	.19	.12	.12	.09	Fine granular, silky center.
8761	103B..........	51,000	118,000	13.1	25.2	.09	.11	.13	.15	.14	.16	.24*	.11	.10	.08	Do.
8762	104A..........	56,000	114,800	14.0	27.4	.10	.11	.13	.15	.13	.14	.27*	.16	.11	.10	Do.
8763	104B..........	52,000	114,800	14.3	27.4	.09	.11	.13	.14	.17	.30*	.16	.13	.11	.09	Do.
8764	105A..........	56,000	109,800	15.7	33.6	.11	.12	.16	.15	.16	.35*	.16	.14	.12	.10	Do.
8765	105B..........	56,000	109,600	14.7	33.6	.10	.11	.11	.13	.15	.31*	.16	.15	.14	.11	Do.
8766	106A..........	48,000	102,800	17.5	35.6	.12	.12	.15	.17	.29	.28*	.17	.18	.15	.12	Silky, with trace of granulation.
8767	106B..........	49,000	102,000	15.7	37.6	.11	.13	.15	.18	.27*	.29*	.14	.11	.09	.10	Silky.
8768	107A..........	50,000	107,200	15.5	31.6	.10	.11	.13	.13	.15	.21	.31*	.16	.13	.12	Fine granular, silky center.
8769	107B..........	51,000	106,200	14.2	29.4	.10	.12	.14	.15	.19	.28*	.12	.13	.11	.08	Do.

LOCOMOTIVE FIRE-BOX PLATES.

STEEL PLATES FROM LOCOMOTIVE FIRE BOXES.

Plates marked 1548 and 1703 were taken from locomotives after they had been in service from three to eight months. The length of service of plate 1401 is not known.

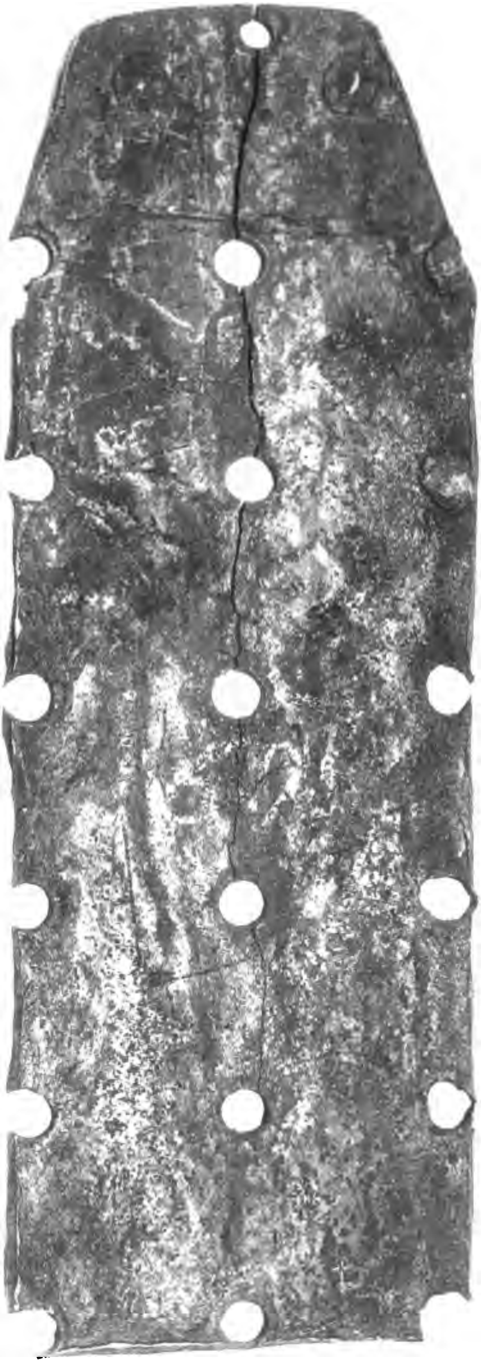
When received for testing these plates had cracks in them and had been repaired in service by means of screw plugs headed down.

The metal between stay bolts was bulged outward on the fire side of the plate.

LOCOMOTIVE FIRE-BOX PLATES.

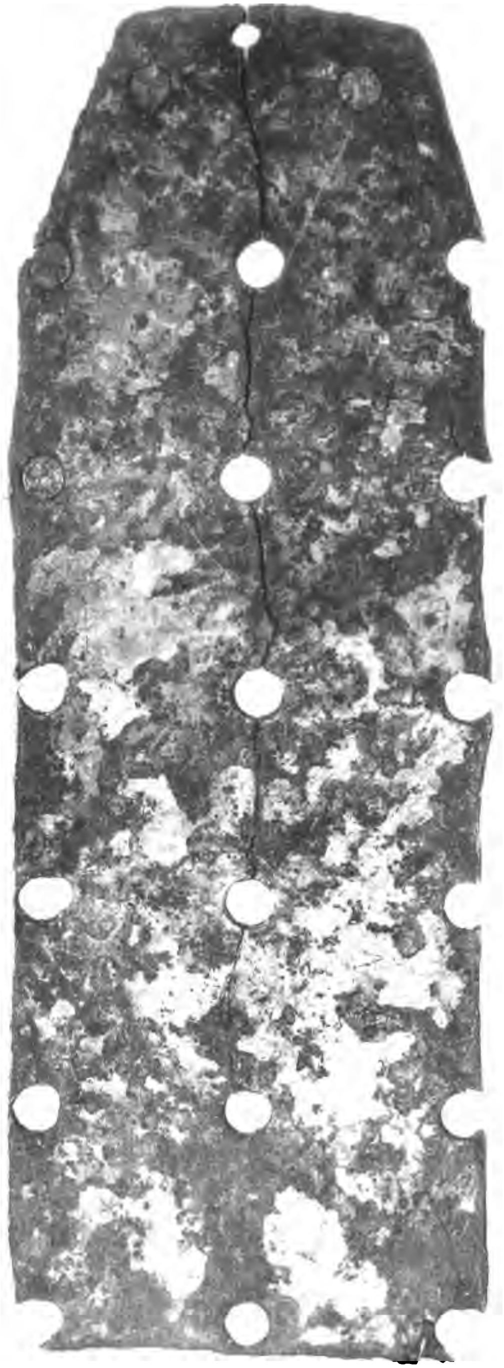
Diagrams showing locations of test pieces in the plates.

Specimens marked for identification C and L, respectively. The direction of rolling of the plates was not known.



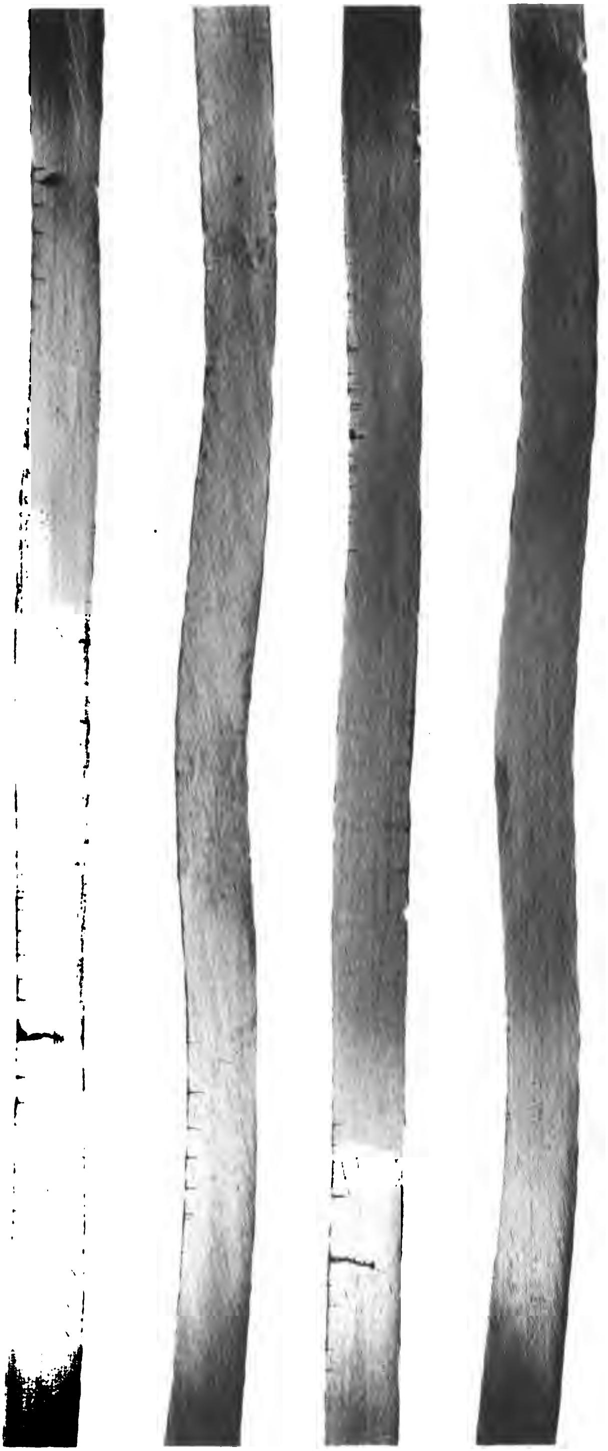
LOCOMOTIVE FIRE-BOX PLATE.

PHOTOGRAPH OF THE FIRE SIDE OF A PART OF A SHEET, SHOWING A CRACK ALONG THE MIDDLE OF ITS WIDTH WHICH WAS FORMED DURING SERVICE.



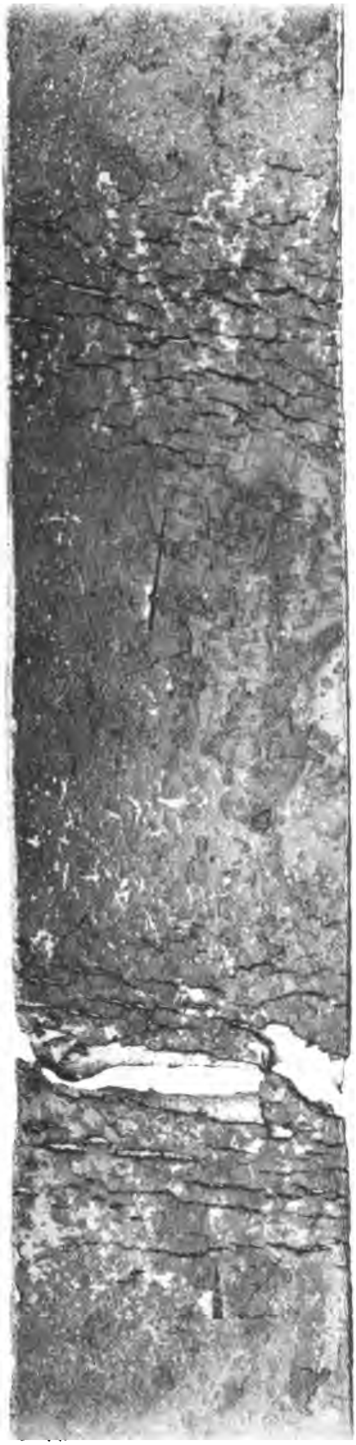
LOCOMOTIVE FIRE-BOX PLATE.

PHOTOGRAPH OF THE WATER SIDE OF A PART OF A SHEET, SHOWING A CRACK ALONG THE MIDDLE OF ITS WIDTH WHICH WAS FORMED DURING SERVICE.



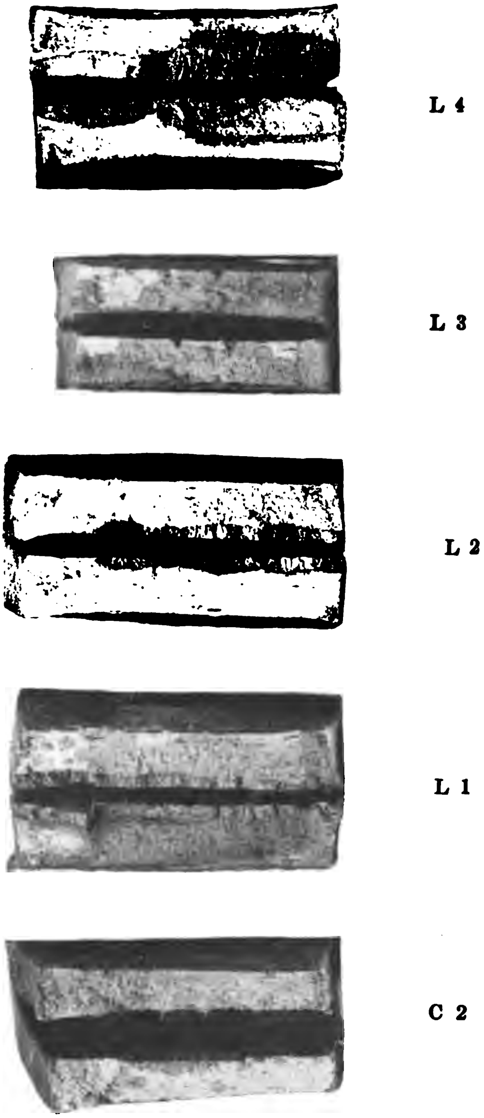
LOCOMOTIVE FIRE-BOX PLATES.

SIDE VIEW OF SPECIMENS L3 AND L4, PLATE R1401, BEFORE TESTING, SHOWING CRACKS ON THE WATER SIDES OF THE PLATE AND BULGING OF THE METAL BETWEEN THE STAY BOLTS.



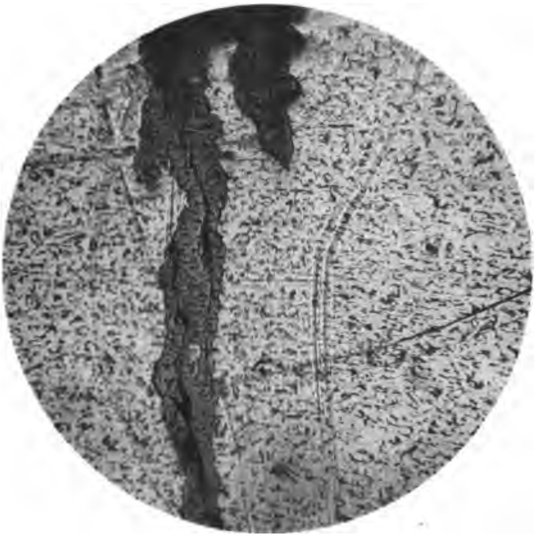
LOCOMOTIVE FIRE-BOX PLATE L1401.

SPECIMEN L1. AFTER TENSILE TEST OF THE METAL, SHOWING CRACKS ON TH
WATER SIDE OF THE PLATE.



LOCOMOTIVE FIRE-BOX PLATES.

APPEARANCE OF FRACTURED ENDS OF TEST PIECES FROM PLATE L1401. CRACKS EXISTED IN PIECES L1 TO L4, INCLUSIVE, BEFORE TESTING.



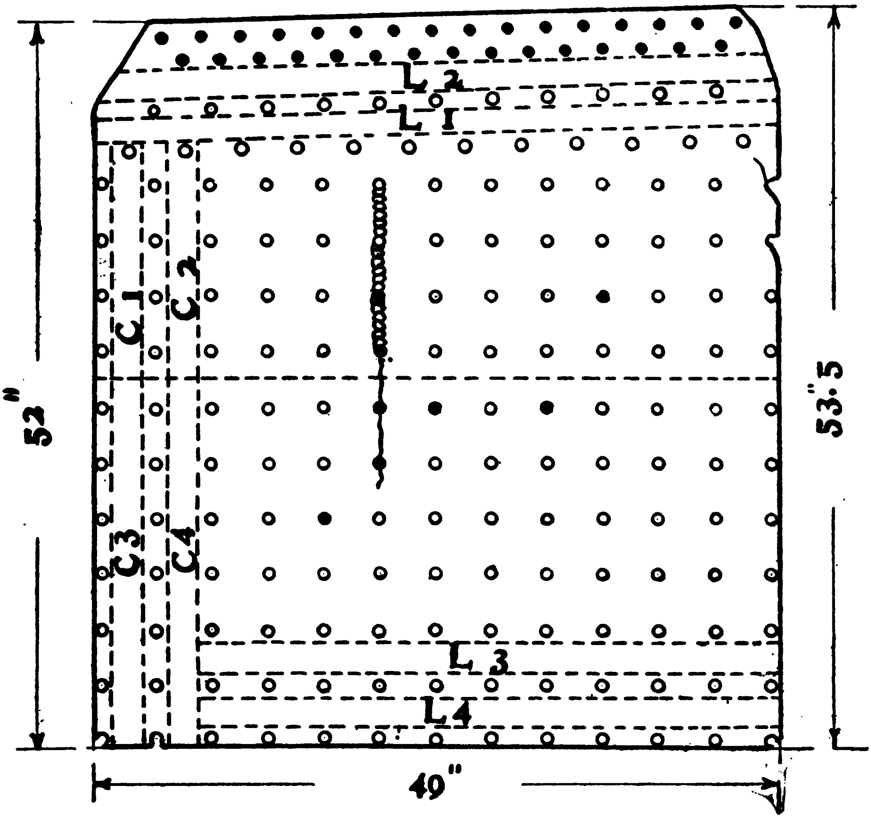
LOCOMOTIVE FIRE-BOX PLATE.

PHOTOMICROGRAPH OF STRUCTURE OF PLATE, WITH A STREAK OF IRON OXIDE ACROSS THE SURFACE MADE BY HEATING A SPECIMEN, WITH AN INCISION, OVER A BUNSEN'S BURNER.

52"

Locomotive Fire-box Plates.

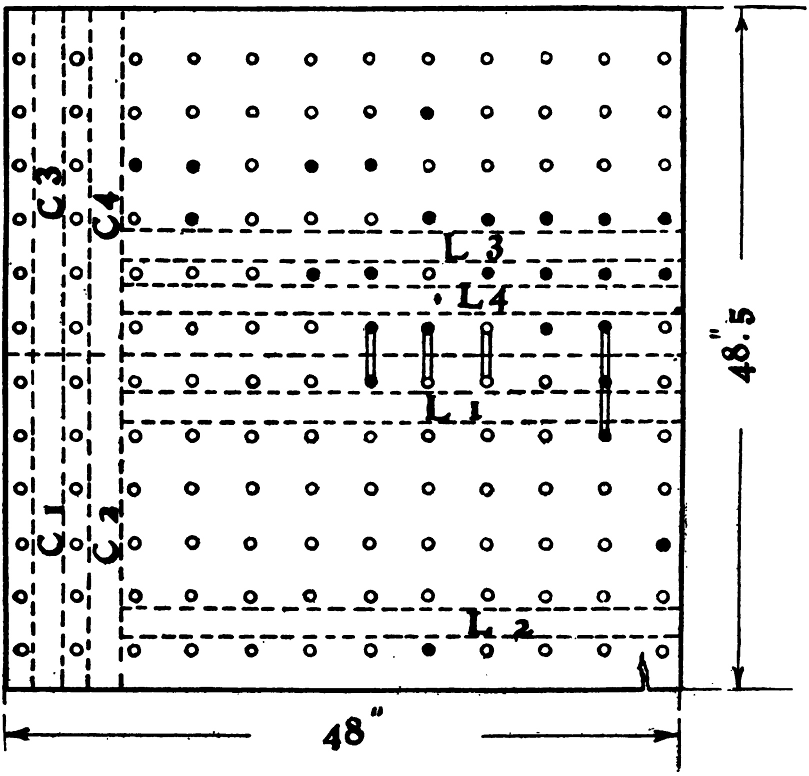
R 1548



$\frac{3}{8}$" plate.

Locomotive Fire-box Plates.

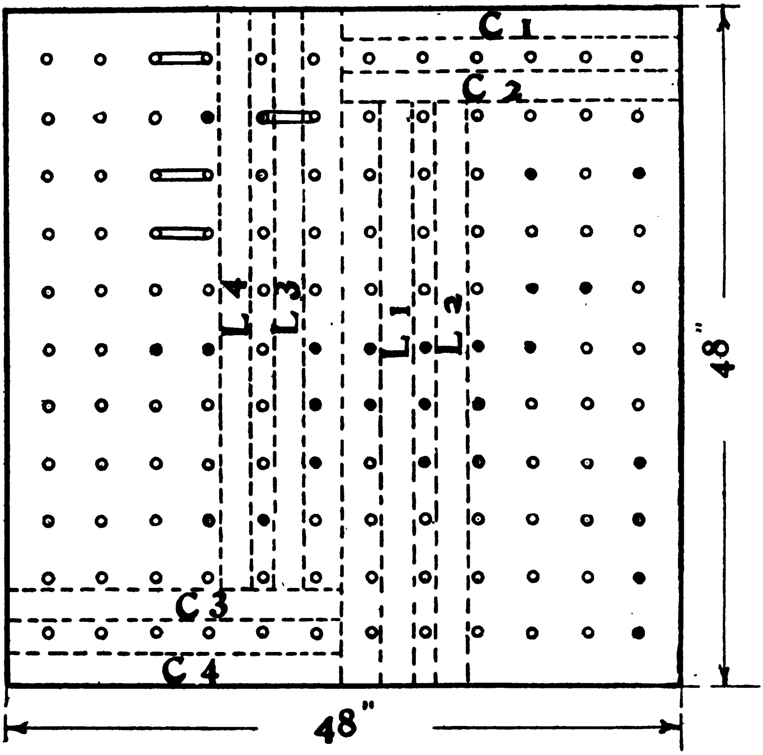
R 1401



⅜" thick.

Locomotive Fire-box Plates.

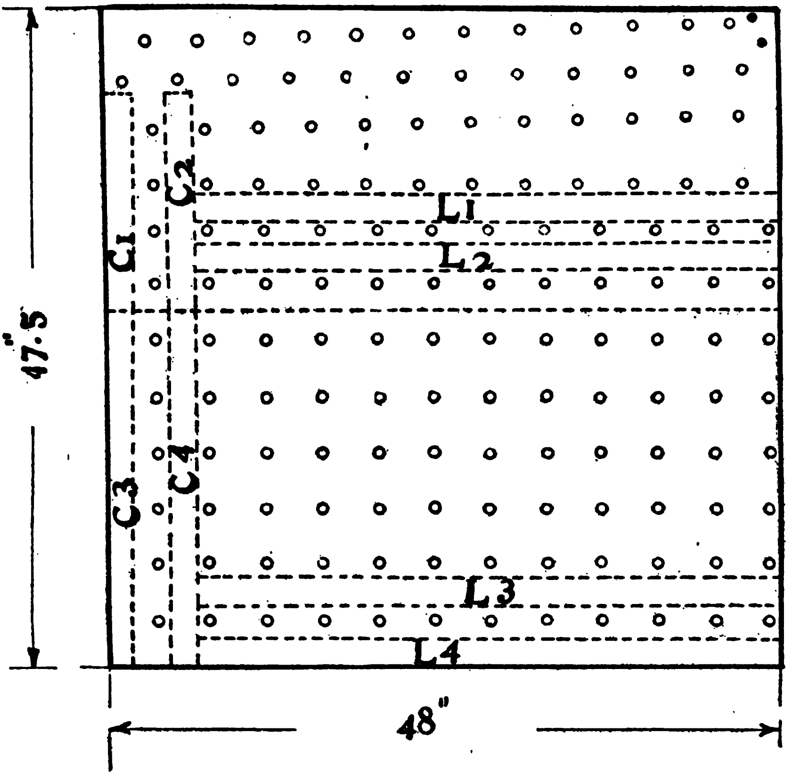
L 1401



$\frac{3}{8}$" plate.

Locomotive Fire-box Plates.

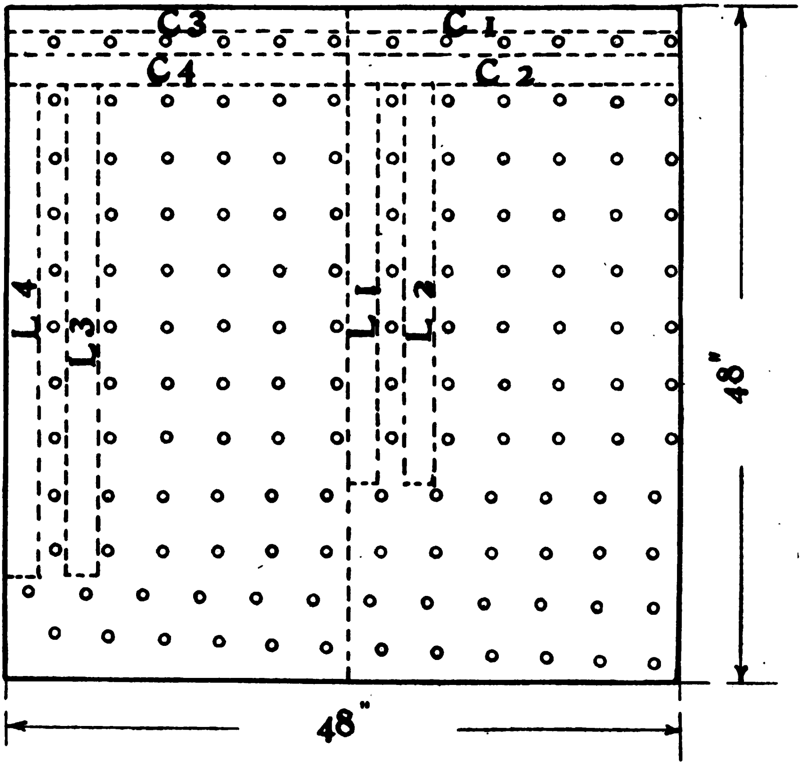
R 1703



$\frac{3}{8}$" thick.

Locomotive Fire-box Plates.

L 1703



⅜" thick.

TENSILE TESTS OF SPECIMENS FROM LOCOMOTIVE FIRE-BOX PLATES.

SPECIMENS FROM PLATE R 1548.

Mark on specimen.	Dimension.		Sectional area.	Elastic limit.		Tensile strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Elongation of inch sections.										Appearance of fracture.
	Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.													
	Inches.	Inch.	Sq. in.	Pounds.	Pounds.	Pounds.	Pounds.			Inches. Sq. in.	Per ct.	″	″	″	″	″	″	″	″	″	″	
L1......	1.88	.42	.789	27,700	35,107	49,700	62,991	1.85	18.5	1.50×.28=.420	46.8	.14	.11	.15	.15	.54*	.17	.14	.14	.16	.15	Silky.
L2......	1.04	.41	.426	....	....	27,600	64,789	2.14	21.4	.77×.28=.216	49.4	.12	.16	.17	.20	.57*	.25	.18	.16	.16	.17	Do.
L3......	1.92	.42	.806	32,000	39,702	51,600	64,020	2.41	24.1	1.46×.30=.438	45.7	.30	.66*	.26	.19	.19	.17	.17	.16	.16	.15	Do.
L4......	1.90	.42	.798	31,900	39,973	51,700	64,787	2.17	21.7	1.45×.29=.421	47.2	.25	.65*	.21	.18	.15	.17	.15	.14	.13	.14	Do.
C1......	1.88	.42	.789	34,600	43,853	53,000	67,174	a 1.13	28.2	1.46×.29=.423	46.4	.18	.57*	.26	.12							Do.
C2......	1.91	.42	.802	33,700	42,020	54,100	67,456	a 1.15	28.7	1.50×.30=.450	43.9	.15	.57*	.28	.15							Do.
C3......	1.87	.43	.799	31,600	39,549	50,900	63,705	2.09	20.9	1.46×.30=.438	45.2	.17	.37	.46*	.19	.17	.16	.14	.15	.16	.12	Do.
C4......	1.86	.43	.804	31,600	39,303	50,900	63,308	2.30	23.0	1.42×.29=.412	48.7	.17	.18	.58*	.32	.21	.21	.19	.15	.15	.14	Do.

a In 4 inches.

SPECIMENS FROM PLATE R 1401.

Mark on specimen.	Width.	Thickness.	Sectional area.	Elastic limit, Total.	Elastic limit, Per square inch.	Tensile strength, Total.	Tensile strength, Per square inch.	Elongation in 10 inches, Inches.	Elongation in 10 inches, Per cent.	Area at fracture.	Contraction of area.	Elongation of inch sections.										Appearance of fracture.
L1......	1.88	.41	.770	32,900	42,727	44,400	57,662	.85	8.5	1.70×.34=.578	24.9	.05	.05	.08	.09	.22*	.11	.09	.05	.06	.05	Silky, 90 per cent; black, 10 per cent. Crack on water side ″.08 deep.
L2......	1.87	.41	.766	31,300	40,862	44,400	57,972	.95	9.5	1.72×.31=.533	30.4	.07	.07	.06	.07	.30*	.10	.07	.07	.07	.07	Silky, 95 per cent; black, 5 per cent. Crack on fire side ″.10 deep.
L3......	1.63	.41	.668	....	....	14,300	20,784	.10	1.0	1.64×.39=.640	4.2	.01	0.	0.	0.	0.	.09*	0.	0.	0.	0.	Solid, 10 per cent; cracked, 90 per cent. Crack on fire side ″.35 deep.
L4......	1.88	.41	.770	....	....	15,000	19,481	.05	.5	1.87×.39=.729	5.3	0.	0.	0.	0.	.05*	0.	0.	0.	0.	0.	Solid, 95 per cent; cracked, 5 per cent. Crack on fire side ″.37 deep.
C1......	1.97	.41	.807	35,100	43,494	51,200	63,445	2.15	21.5	1.54×.28=.376	53.4	.62*	.23	.16	.18	.18	.16	.15	.18	.15	.14	Silky.
C2......	1.96	.41	.803	34,200	42,590	51,000	63,512	1.87	18.7	1.56×.29=.452	43.7	.30	.15	.15	.18	.14	.20	.20	.19	.20	.16	Do.
C3......	1.52	.31	.471	26,700	56,688	34,900	74,098	.56	5.6	1.32×.24=.317	32.7	.19	.09	.04	.03	.04	.04	.02	.04	.03	.04	Do.
C4......	1.90	.31	.589	36,300	61,630	42,800	72,666	.39	3.9	1.56×.24=.374	36.5	.13*	.03	.03	.03	.03	.03	.03	.02	.03	.03	Do.

TENSILE TESTS OF SPECIMENS FROM LOCOMOTIVE FIRE-BOX PLATES—Continued.

SPECIMENS FROM PLATE L 1401.

Mark on specimen.	Dimension.		Sectional area.	Elastic limit.		Tensile strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Elongation of inch sections.										Appearance of fracture.
	Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.													
	Inches.	*Inch.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inches. Sq. in.*	*Per ct.*	"	"	"	"	"	"	"	"	"	"	
L1......	1.81	.40	.724	34,700	47,928	38,000	52,486	.76	7.6	1.66×.34=.564	22.1	.04	.05	.08	.24*	.07	.06	.05	.05	.06	.06	Silky, 75 per cent; black, 25 per cent; black, ".06 deep. Crack on water side 4" interior.
L2......	1.87	.40	.748	32,300	43,182	37,700	50,401	.52	5.2	1.70×.35=.595	20.4	.21*	.04	.05	.03	.03	.04	.04	.03	.02	.03	Silky, 75 per cent; black, 25 per cent; black, ".06 deep. Crack on water side 4" interior.
L3......	1.70	.39	.663	26,100	39,367	38,400	57,919	2.41	24.1	1.31×.25=.328	50.5	.19	.20	.20	.23	.71*	.25	.18	.15	.14	.16	Silky, 75 per cent; cracked, 25 per cent. Crack on water side ".08 deep.
L4......	1.64	.40	.656	....	....	22,000	33,537	.15	1.5	1.38×.35=.553	15.7	0.	0.	.01	.01	.12*	0.	.01	0.	0.	0.	Solid, 65 per cent; cracked, 35 per cent. Crack on fire side ".28 deep.
C1......	1.96	.40	.784	30,000	38,265	38,400	48,980	.80	8.0	1.58×.22=.348	55.6	.50*	.09	.04	.03	.03	.02	.02	.02	.02	.03	Silky.
C2......	1.90	.33	.627	30,100	48,006	37,000	59,011	.96	9.6	1.52×.22=.334	46.7	.60*	.13	.04	.03	.03	.03	.02	.02	.03	.03	Do.
C3......	1.98	.40	.792	29,500	37,247	46,500	58,712	2.13	21.3	1.70×.30=.510	35.6	.20	.42*	.27	.25	.21	.18	.14	.18	.13	.15	Do.
C4......	1.98	.40	.792	27,200	34,343	45,600	57,576	2.61	26.1	1.57×.27=.424	46.5	.17	.21	.25	.29	.63*	.29	.23	.19	.17	.18	Do.

TENSILE TESTS OF SPECIMENS FROM LOCOMOTIVE FIRE-BOX PLATES—Continued.

SPECIMENS FROM PLATE R 1703.

Mark on specimen.	Dimension.		Sectional area.	Elastic limit.		Tensile strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Elongation of inch sections.										Appearance of fracture.
	Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.													
	Inches.	*Inch.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inches. Sq. in.*	*Per ct.*	"	"	"	"	"	"	"	"	"	"	
L1......	1.74	.40	.696	30,200	43,391	32,000	45,977	.30	3.0	1.72×.35=.602	13.5	.14*	.01	.01	.02	.03	.02	.01	.01	.02	.03	Solid, 70 per cent; cracked, 30 per cent. Crack on fire side ".12 deep.
L2......	2.05	.40	.820	34,000	41,463	38,500	46,951	.28	2.8	2.00×.36=.720	12.2	.02	.12*	.01	.02	.02	.02	.03	.01	.02	.01	Solid, 70 per cent; cracked, 30 per cent. Crack on fire side ".15 deep.
L3......	1.87	.39	.729	27,000	37,037	44,900	61,591	2.51	25.1	1.40×.26=.364	50.1	.20	.24	.22	.27	.71*	.26	.18	.15	.14	.14	Silky.
L4......	1.89	.40	.756	28,200	37,301	44,900	59,392	2.23	22.3	1.43×.26=.372	50.8	.23	.67*	.26	.19	.19	.15	.15	.14	.12	.13	Do.
C1.	1.84	.40	.736	33,300	45,245	47,600	64,674	[a] 1.17	29.2	1.48×.28=.414	43.8	.25	.55*	.21	.16							Do.
C2......	1.96	.40	.784	31,600	40,306	49,500	63,138	[a] 1.10	27.5	1.56×.27=.421	46.3	.16	.54*	.26	.14							Do.
C3......	1.89	.40	.756	30,200	39,947	47,900	63,360	2.31	23.1	1.47×.27=.397	47.5	.20	.15	.21	.41	.52*	.23	.14	.13	.15	.17	Do.
C4......	1.98	.40	.792	30,500	38,510	49,000	61,869	2.81	28.1	1.50×.30=.450	43.2	.24	.29	.31	.71*	.30	.21	.19	.19	.19	.18	Do.

[a] In 4 inches.

SPECIMENS FROM PLATE L 1703.

L1......	1.94	.40	.776	27,800	35,825	49,000	63,144	2.03	20.3	1.51×.26=.393	49.4	.29	.51*	.15	.15	.16	.16	.16	.15	.16	.14	Silky.
L2......	1.79	.40	.716	27,900	38,966	44,900	62,709	1.50	15.0	1.38×.25=.345	51.8	.28	.14	.14	.16	.10	.08	.17	.16	.14	.13	Do.
L3......	2.03	.40	.812	31,200	38,424	51,900	63,916	1.97	19.7	1.65×.30=.495	39.0	.26	.53*	.22	.16	.13	.14	.15	.13	.12	.13	Do.
L4......	1.91	.41	.783	31,600	40,358	49,200	62,835	2.07	20.7	1.52×.30=.456	41.8	.18	.16	.14	.17	.17	.48*	.28	.16	.18	.15	Do.
C1......	1.68	.39	.655	25,900	39,542	41,400	63,206	2.09	20.9	1.30×.25=.325	50.4	.15	.21	.41	.48*	.18	.15	.12	.11	.14	.14	Do.
C2......	1.74	.40	.696	25,200	36,207	42,300	60,775	2.26	22.6	1.34×.27=.362	48.0	.18	.33	.52*	.21	.20	.17	.16	.15	.18	.16	Do.
C3......	1.94	.40	.776	29,600	38,144	48,800	62,887	2.31	23.1	1.47×.28=.412	46.9	.16	.18	.21	.25	.67*	.23	.18	.15	.14	.14	Do.
C4......	2.00	.40	.800	31,200	39,000	49,700	62,125	2.32	23.2	1.53×.27=.413	48.4	.18	.18	.18	.20	.28	.62*	.24	.13	.17	.14	Do.

STEEL BARS.

TENSILE TESTS OF METAL USED IN ENDURANCE TESTS, FURNISHED UNDER THE TRADE NAMES "AMORPHOUS" AND "SORBITIC."

(See Reports of 1903, 1904, 1905, 1907, and 1908 for record of endurance tests.)

No. 8679.

Marks, AM 834–10–1.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0015	0.	
10,000	.0031	....	
20,000	.0070	....	
30,000	.0108	....	
60,000	.0212	....	
65,000	.0230	....	
70,000	.0248	....	
72,000	.0254	....	
74,000	.0260	....	
78,000	.0275	....	
82,000	.0290	....	
86,000	.0302	....	
90,000	.0318	....	
94,000	.0331	....	
98,000	.0344	....	
100,000	.0351	....	
105,000	.0371	....	
110,000	.0390	....	
111,000	.0392	....	
112,000	.0398	....	
113,000	.0401	....	
114,000	.0408	....	
115,000	.0412	....	
116,000	.0417	....	
117,000	.0420	....	
118,000	.0425	....	
119,000	.0428	....	
120,000	.0431	....	
121,000	.0435	....	
122,000	.0440	....	
123,000	.0446	....	
124,000	.0452	....	
125,000	.0458	....	
126,000	.0467	....	
127,000	.0475	....	
128,000	.0485	....	
129,000	.0492	....	
130,000	.0508	....	
131,000	.0519	....	
132,000	.0535	....	
134,000	.06	....	
135,000	.07	....	
144,800	....	....	Tensile strength.
0	.70	....	=7 per cent elongation in 10″.

Elongation of inch sections, ″.02, ″.03, ″.03, ″.03, ″.03, ″.04, ″.04, ″.04, ″.10, ″.34*.

Diameter at fracture, ″.52; area, .212 square inch.

Contraction of area, 57.6 per cent.

Fractured 1″.40 from the neck.

Appearance of fracture, fine silky, cup shaped.

Elastic limit not well defined.

No. 8680.

Marks, AM 834–10–2.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load
5,000	.0018	0.	
10,000	.0034	....	
20,000	.0070	....	
30,000	.0108	....	
35,000	.0125	.0007	
40,000	.0141	....	
45,000	.0159	.0008	
50,000	.0179	.0009	
55,000	.0196	.0010	
60,000	.0213	....	
65,000	.0231	....	
70,000	.0250	....	
82,000	.04	....	
100,000	.05	....	
120,000	.06	....	
124,000	.08	....	
128,000	.10	....	
130,000	.12	....	
132,000	.15	....	
134,000	.22	....	
135,000	.27	....	
138,800	....	....	Tensile strength.
0	.83	....	= 8.3 per cent elongation in 10″.

Elongation of inch sections, ″.03, ″.05, ″.04, ″.04, ″.05, ″.15, ″.35*, ″.06, ″.04, ″.02.
Diameter at fracture, ″.52; area, .212 square inch.
Contraction of area, 57.6 per cent.
Fractured 4″.30 from the neck.
Appearance of fracture, fine silky, cup shaped.
Elastic limit not well defined.

No. 8681.

Marks, SO 90–11–1.
Diameter, ″.798.
Sectional area, .50 square inch.
Gauged length, 10″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0013	0.	
10,000	.0032	....	
20,000	.0070	....	
30,000	.0108	....	
60,000	.0208	....	
65,000	.0224	....	
70,000	.0242	....	
72,000	.0250	....	
74,000	.0258	....	
76,000	.0267	....	Elastic limit, approximate.
78,000	.2010	....	
80,000	.2200	....	
82,000	.2550	....	
84,000	.2790	....	
86,000	.3100	....	
88,000	.37	....	
92,000	.45	....	
96,000	.58	....	
98,000	.68	....	
100,000	.85	....	
101,800	....	....	Tensile strength.
0	1.50	....	=15 per cent elongation in 10″.

Elongation of inch sections, ″.07, ″.09, ″.10, ″.12, ″.15, ″.50*, ″.15, ″.12, ″.11, ″.09.
Diameter at fracture, ″.51; area, .204 square inch.
Contraction of area, 59.2 per cent.
Fractured 5″.30 from the neck.
Appearance of fracture, fine silky, cup shaped.

No. 8682.

Marks, SO 90-11-2.
Diameter, ''.798.
Sectional area, .50 square inch.
Gauged length, 10''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0014	0.	
10,000	.0031	....	
20,000	.0070	....	
30,000	.0106	....	
60,000	.0210	....	
65,000	.0228	....	
70,000	.0243	....	
72,000	.0251	....	
74,000	.0259	....	
76,000	.0268	....	Elastic limit, approximate.
78,000	.2040	....	
80,000	.2200	....	
82,000	.2560	....	
84,000	.2820	....	
86,000	.3100	....	
88,000	.3490	....	
90,000	.3960	....	
92,000	.45	....	
94,000	.52	....	
96,000	.59	....	
98,000	.69	....	
100,000	.86	....	
101,800	....	....	Tensile strength.
0	1.54	....	=15.4 per cent elongation in 10''.

Elongation of inch sections, ''.08, ''.09, ''.10, ''.12, ''.15, ''.52*, ''.16, ''.12, ''.11, ''.09.

Diameter at fracture, ''.51; area, .204 square inch.

Contraction of area, 59.2 per cent.

Fractured 5''.30 from the neck.

Appearance of fracture, fine silky, cup shaped.

No. 8560.

[illegible]

Remarks.

[illegible]

... strength.
... per cent elongation in 3".

[illegible] .4, ".05, ".32*.
[illegible] area, .1075 square inch.
[illegible]
[illegible]
[illegible] silky, cup shaped.
[illegible]

No. 8561.

Marks, AM 834–10–2, No. 413.
Diameter, ″.564.
Sectional area, .25 square inch
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0020	....	
40,000	.0041	.0001	
45,000	.0045	....	
50,000	.0049	.0002	
55,000	.0053	....	
60,000	.0060	.0002	
65,000	.0065	....	
70,000	.0070	.0003	
75,000	.0078	.0003	
80,000	.0084	.0003	
85,000	.0090	....	
90,000	.0095	....	
95,000	.0102	....	
100,000	.0108	....	
105,000	.0118	....	
110,000	.0127	....	
112,000	.0130	....	
114,000	.0135	....	
116,000	.0140	....	
118,000	.0147	....	
120,000	.0153	....	
126,000	.0217	....	
130,000	.0295	....	
134,000	.0470	....	
136,000	.0660	....	
138,000	.0990	....	
139,000	.12	....	
139,600	....	....	Tensile strength.
0	.46	....	=15.3 per cent elongation in 3″.

Elongation of inch sections, ″.07, ″.32*, ″.07.
Diameter at fracture, ″.36; area, .1018 square inch.
Contraction of area, 59.3 per cent.
Fractured 1″.50 from the neck.
Appearance of fracture, fine silky, cup shaped.
Elastic limit not well defined.

No. 8562.

Marks, SO 90-11-1, No. 416.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0019	....	
30,000	.0027	0.	
40,000	.0041	0.	
50,000	.0047	0.	
60,000	.0060	0.	
70,000	.0068	0.	
71,000	.0070	....	
72,000	.0072	....	
73,000	.0076	....	Elastic limit.
74,000	.0200	....	
75,000	.0400	....	
76,000	.0450	....	
77,000	.0480	....	
78,000	.0510	....	
79,000	.0545	....	
80,000	.0565	....	
82,000	.0720	....	
84,000	.0760	....	
86,000	.0850	....	
88,000	.0980	....	
90,000	.1100	....	
94,000	.15	....	
98,000	.20	....	
100,000	.24	....	
101,000	.27	....	
102,000	.36	....	
102,000	....	....	Tensile strength.
0	.70	....	=23.3 per cent elongation in 3''.

Elongation of inch sections, ''.12, ''.22, ''.36*.
Diameter at fracture, ''.35; area, .0962 square inch.
Contraction of area, 61.5 per cent.
Fractured, 1''.20 from the neck.
Appearance of fracture, fine silky, serrated.

No. 8563.

Marks, SO 90–11–2, No. 414.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0010	....	
20,000	.0020	....	
30,000	.0031	0.	
40,000	.0042	0.	
45,000	.0047	0.	
50,000	.0051	0.	
55,000	.0056	0.	
60,000	.0061	0.	
65,000	.0068	....	Elastic limit.
70,000	.0074	....	
	.0345	.0001	
71,000	.0372	....	
72,000	.0383	....	
74,000	.0445	....	
76,000	.0527	....	
78,000	.0607	....	
80,000	.0704	....	
82,000	.0777	....	
84,000	.0892	....	
86,000	.0998	....	
88,000	.1134	....	
90,000	.1258	....	
94,000	.15	....	
98,000	.21	....	
100,000	.29	....	
101,000	.40	....	
102,000	....	....	Tensile strength.
0	.69	....	=23 per cent elongation in 3″.

Elongation of inch sections, ″.12, ″.18. ″.39*.
Diameter at fracture, ″.35; area, .0962 square inch.
Contraction of area, 61.5 per cent.
Fractured 1″.15 from the neck.
Appearance of fracture, fine silky.

STEEL BARS FROM ENDURANCE TESTS.

Tensile tests of specimens from ends of ruptured endurance shafts.

No. 8809.

Marks, C370.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0030	0.	
35,000	.0039	....	
40,000	.0057	.0017	
41,000	.0062	....	
42,000	.0068	....	
43,000	.0073	....	Elastic limit.
44,000	.0100	....	
45,000	.0113	.0063	
46,000	.0132	....	
47,000	.0149	....	
48,000	.0213	....	
49,000	.0253	....	
50,000	.0323	....	
51,000	.0365	....	
52,000	.0433	....	
53,000	.0508	....	
54,000	.0575	....	
55,000	.0820	....	
56,000	.10	....	
57,000	.12	....	
58,000	.13	....	
59,000	.30	....	
60,000		....	Tensile strength.
0	.63	....	=21 per cent elongation in 3''.

Elongation of inch sections, ''.13, ''.17, ''.33*.
Diameter at fracture, ''.40; area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 1''.15 from the neck.
Appearance of fracture, fibrous, seams along stem.

No. 8810.

Marks, .17 C371.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0029	0.	
35,000	.0033	0.	
40,000	.0039	0.	
45,000	.0044	0.	
50,000	.0049	0.	Elastic limit.
51,000	.0990	....	
52,000	.1007	....	
53,000	.1083	....	
54,000	.1142	....	
55,000	.1245	....	
56,000	.13	....	
58,000	.15	....	
60,000	.18	....	
62,000	.20	....	
64,000	.24	....	
66,000	.30	....	
68,000	.37	....	
69,000	.42	....	
70,000	.53	....	
70,800	....	....	Tensile strength.
0	.95	....	=31.7 per cent elongation in 3″.

Elongation of inch sections, ″.22, ″.48*, ″.25.
Diameter at fracture, ″.37; area, .1075 square inch.
Contraction of area, 57 per cent.
Fractured at center of stem.
Appearance of fracture, fine silky.

No. 8811.

Marks, .17 C372.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0007	....	
20,000	.0017	....	
30,000	.0027	0.	
35,000	.0033	0.	
40,000	.0038	0.	
41,000	.0039	....	
42,000	.0040	....	
43,000	.0041	....	
44,000	.0042	....	Elastic limit.
45,000	.0700	.0653	
46,000	.0747	....	
47,000	.0752	....	
48,000	.0778	....	
49,000	.0812	....	
50,000	.0855	....	
55,000	.1228	....	
60,000	.1800	....	
62,000	.20	....	
64,000	.24	....	
66,000	.29	....	
68,000	.37	....	
70,000	.53	....	
70,800	....	....	Tensile strength.
0	.95	....	=31.7 per cent elongation in 3″.

Elongation of inch sections, ″.23, ″.51*, ″.21.
Diameter at fracture, ″.37; area, .1075 square inch.
Contraction of area, 57 per cent.
Fractured at middle of stem.
Appearance of fracture, fine silky.

No. 8812.

Marks, .17 C373.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	....	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0028	0.	
35,000	.0033	0.	
40,000	.0038	0.	
45,000	.0043	0.	
50,000	.0048	0.	
51,000	.0049	....	Elastic limit.
52,000	.1020	....	
53,000	.1056	....	
54,000	.1121	....	
55,000	.1230	....	
56,000	.1275	....	
57,000	.1450	....	
58,000	.1503	....	
59,000	.1680	....	
60,000	.1760	....	
62,000	.20	....	
64,000	.24	....	
66,000	.29	....	
68,000	.37	....	
70,000	.50	....	
70,800	....	....	Tensile strength.
0	.96	....	=32 per cent elongation in 3″.

Elongation of inch sections, ″.21, ″.51*, ″.24.
Diameter at fracture, ″.37; area, .1075 square inch.
Contraction of area, 57 per cent.
Fractured 2″ from the neck.
Appearance of fracture, fine silky.

No. 8813.

Marks, .17 C374.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0027	0.	
35,000	.0032	0.	
40,000	.0037	0.	
45,000	.0042	0.	
46,000	.0043	....	Elastic limit.
47,000	.0737	....	
48,000	.0774	....	
49,000	.0813	....	
50,000	.0887	.0835	
51,000	.0923	....	
52,000	.0965	....	
53,000	.1070	....	
54,000	.1140	....	
55,000	.1225	....	
60,000	.1745	....	
62,000	.20	....	
64,000	.23	....	
66,000	.28	....	
68,000	.34	....	
69,000	.40	....	
70,000	.49	....	
70,800	....	....	Tensile strength.
0	.96	....	=32 per cent elongation in 3″.

Elongation of inch sections, ″.24, ″.50*, ″.22.
Diameter at fracture, ″.37; area, .1075 square inch.
Contraction of area, 57 per cent.
Fractured 1″.90 from the neck.
Appearance of fracture, fine silky.

No. 8814.

Marks, .17 C375.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0019	....	
30,000	.0029	0.	
35,000	.0034	0.	
40,000	.0039	0.	
45,000	.0045	....	
46,000	.0046	....	
47,000	.0047	....	Elastic limit.
48,000	.0785	....	
49,000	.0818	....	
50,000	.0877	....	
51,000	.0920	....	
52,000	.0986	....	
53,000	.1076	....	
54,000	.1135	....	
55,000	.1257	....	
60,000	.1760	....	
62,000	.21	....	
64,000	.25	....	
66,000	.31	....	
68,000	.39	....	
69,000	.47	....	
70,000	.57	....	
70,400	....	....	Tensile strength.
0	.97	....	=32.3 per cent elongation in 3″.

Elongation of inch sections, ″.23, ″.51*, ″.23.
Diameter at fracture, ″.37; area, .1075 square inch.
Contraction of area, 57 per cent.
Fractured 2″ from the neck.
Appearance of fracture, fine silky.

No. 8815.

Marks, .17 C376.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0006	....	
20,000	.0017	....	
30,000	.0026	−.0001	
35,000	.0030	−.0001	
40,000	.0036	−.0001	
45,000	.0039	−.0001	Elastic limit.
46,000	.0698	....	
47,000	.0728	....	
48,000	.0765	....	
49,000	.0814	....	
50,000	.0855	.0803	
51,000	.0897	....	
52,000	.0985	....	
53,000	.1070	....	
54,000	.1135	....	
55,000	.1265	....	
60,000	.1760	....	
62,000	.20	....	
64,000	.24	....	
66,000	.29	....	
68,000	.38	....	
70,000	.55	....	
70,400	....	....	Tensile strength.
0	.97	....	=32.3 per cent elongation in 3″.

Elongation of inch sections, ″.22, ″.52*, ″.23.
Diameter at fracture, ″.37; area, .1075 square inch.
Contraction of area, 57 per cent.
Fractured 2″.05 from the neck.
Appearance of fracture, fine silky, cup shaped.

No. 8816.

Marks, .55 C377.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0028	0.	
35,000	.0033	−.0002	
50,000	.0047	−.0002	
55,000	.0052	−.0002	
56,000	.0055	....	Elastic limit.
57,000	.0095	....	
58,000	.0230	....	
59,000	.0240	....	
60,000	.0250	....	
61,000	.0268	....	
62,000	.0283	....	
63,000	.0295	....	
64,000	.0320	....	
65,000	.0337	....	
70,000	.05	....	
80,000	.07	....	
90,000	.10	....	
100,000	.16	....	
105,000	.20	....	
108,000	.26	....	
110,000	.34	....	
110,800	....	....	Tensile strength.
0	.50	....	=16.7 per cent elongation in 3″.

Elongation of inch sections, ″.12, ″.15, ″.23*.
Diameter at fracture, ″.47; area, .1735 square inch.
Contraction of area, 30.6 per cent.
Fractured 1″ from the neck.
Appearance of fracture, fine granular 50 per cent, silky 50 per cent.

No. 8817.

Marks, .55 C378.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0017	....	
30,000	.0027	0.	
32,000	.0119	....	
110,800	....	....	Tensile strength.
0	.55	....	=18.3 per cent elongation in 3''.

Elongation of inch sections, ''.14, ''.27*, ''.14.
Diameter at fracture, ''.47; area, .1735 square inch.
Contraction of area, 30.6 per cent.
Fractured 1''.80 from the neck.
Appearance of fracture, silky 85 per cent, granular 15 per cent.

No. 8818.

Marks, .55 C379.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0003	....	
20,000	.0018	....	
30,000	.0029	0.	
35,000	.0034	0.	
40,000	.0040	0.	
45,000	.0046	0.	
50,000	.0051	.0001	
55,000	.0057	.0001	
56,000	.0058	....	
57,000	.0060	....	Elastic limit.
58,000	.0236	....	
59,000	.0247	....	
60,000	.0258	....	
61,000	.0277	....	
62,000	.0315	....	
63,000	.0337	....	
64,000	.0345	....	
65,000	.0349	....	
70,000	.0441	....	
75,000	.0563	....	
80,000	.0685	....	
90,000	.1005	....	
100,000	.1527	....	
105,000	.21	....	
108,000	.26	....	
110,000	.34	....	
110,800	....	....	Tensile strength.
0	.55	....	=18.3 per cent elongation in 10″.

Elongation of inch sections, ″.14, ″.27*, ″.14.
Diameter at fracture, ″.46; area, .1662 square inch.
Contraction of area, 33.5 per cent.
Fractured 1″.80 from the neck.
Appearance of fracture, silky 85 per cent, granular 15 per cent.

[illegible] square inch.

[illegible] granular 15 per cent.

No. 8820.

Marks, .55 C381.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0028	0.	
35,000	.0033	0.	
40,000	.0038	0.	
45,000	.0043	0.	
50,000	.0048	0.	
55,000	.0054	0.	
56,000	.0055	....	Elastic limit.
57,000	.0208	....	
58,000	.0221	....	
59,000	.0232	....	
60,000	.0248	....	
61,000	.0266	....	
62,000	.0277	....	
63,000	.0288	....	
64,000	.0310	....	
65,000	.0327	....	
70,000	.0427	....	
75,000	.0542	....	
80,000	.0665	....	
90,000	.0970	....	
100,000	.1475	....	
105,000	.20	....	
108,000	.24	....	
110,000	.31	....	
110,800	....	....	Tensile strength.
0	.55	....	=18.3 per cent elongation in 3″.

Elongation of inch sections, ″.15, ″.27*, ″.13.
Diameter at fracture, ″.47; area, .1735 square inch.
Contraction of area, 30.6 per cent.
Fractured 1″.85 from the neck.
Appearance of fracture, silky 85 per cent, granular 15 per cent.

No. 8821.

Marks, .73 C417.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0029	0.	
35,000	.0034	0.	
40,000	.0039	0.	
45,000	.0046	0.	
50,000	.0049	0.	
55,000	.0055	0.	
60,000	.0061	0.	
61,000	.0063	....	
62,000	.0064	....	
63,000	.0066	....	
64,000	.0069	....	
65,000	.0072	.0004	Elastic limit.
66,000	.0080	....	
67,000	.0085	....	
68,000	.0093	....	
69,000	.0102	....	
70,000	.0110	....	
75,000	.0162	....	
80,000	.03	....	
90,000	.04	....	
100,000	.06	....	
110,000	.08	....	
120,000	.10	....	
130,000	.14	....	
140,000	.28	....	
140,800	....	....	Tensile strength.
0	.34	....	= 11.3 per cent elongation in 3″.

Elongation of inch sections, ″.13, ″.11, ″.10.
Diameter at fracture, ″.51; area, .2043 square inch.
Contraction of area, 18.3 per cent.
Fractured 1″.20 from the neck.
Appearance of fracture, fine granular.

No. 8822.

Marks, .82 C382.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0028	−.0002	
65,000	.0063	−.0002	Elastic limit.
66,000	.0077	....	
67,000	.0118	....	
68,000	.0131	....	
69,000	.0140	....	
70,000	.0143	....	
71,000	.0160	....	
72,000	.0164	....	
73,000	.0175	....	
74,000	.0186	....	
75,000	.0198	....	
80,000	.0254	....	
90,000	.0382	....	
100,000	.0527	....	
110,000	.0836	....	
120,000	.10	....	
130,000	.13	....	
140,000	.21	....	
142,000	.27	....	Tensile strength.
0	.28	....	=9.3 per cent elongation in 3''.

Elongation of inch sections, ''.08, ''.12*,''.08.
Diameter at fracture, ''.53.; area, .2206 square inch.
Contraction of area, 11.8 per cent.
Fractured 1''.30 from the neck.
Appearance of fracture, fine granular.

No. 8823.

Marks, .82 C384.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0028	0.	
35,000	.0033	0.	
40,000	.0038	0.	
45,000	.0043	0.	
50,000	.0048	0.	
55,000	.0053	0.	
60,000	.0058	0.	
65,000	.0064	0.	Elastic limit.
66,000	.0085	....	
67,000	.0127	....	
68,000	.0165	....	
69,000	.0174	....	
70,000	.0183	....	
71,000	.0198	....	
73,000	.0217	....	
75,000	.0237	....	
76,000	.0256	....	
78,000	.0269	....	
80,000	.0297	....	
90,000	.0424	....	
100,000	.0582	....	
120,000	.1010	....	
124,000	.1155	....	
128,000	.1298	....	
132,000	.1540	....	
134,000	.1650	....	
136,000	.1950	....	
138,000	.2300	....	
140,000	....	....	Tensile strength.
0	.25	....	=8.3 per cent elongation in 3''.

Elongation of inch sections,''.08, ''.10*, ''.07.
Diameter at fracture, ''.54; area, .2290 square inch.
Contraction of area, 8.4 per cent.
Fractured 1''.15 from the neck.
Appearance of fracture, fine granular.

No. 8824.

Marks, .82 C386.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0029	0.	
35,000	.0035	0.	
40,000	.0040	0.	
45,000	.0046	0.	
50,000	.0052	0.	
55,000	.0056	0.	
60,000	.0062	0.	
65,000	.0069	.0003	Elastic limit.
66,000	.0093	....	
67,000	.0102	....	
68,000	.0112	....	
69,000	.0122	....	
70,000	.0133	....	
71,000	.0146	....	
73,000	.0161	....	
75,000	.0179	....	
76,000	.0197	....	
78,000	.0211	....	
80,000	.0233	....	
90,000	.0353	....	
100,000	.0495	....	
110,000	.0660	....	
120,000	.0880	....	
125,000	.1010	....	
130,000	.1170	....	
132,000	.1240	....	
134,000	.14	....	
136,000	.15	....	
138,000	.16	....	
140,000	.18	....	
142,000	.20	....	
145,200	....	....	Tensile strength.
0	.26	....	=8.7 per cent elongation in 3″.

Elongation of inch sections, ″.08, ″.10*, ″.08.
Diameter at fracture, ″.54; area, .2290 square inch.
Contraction of area, 8.4 per cent.
Fractured 1″.25 from the neck.
Appearance of fracture, fine granular.

No. 8843.

Marks, .82 C387.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0018	....	
30,000	.0029	.0001	
35,000	.0034	.0001	
40,000	.0039	.0001	
45,000	.0045	.0001	
50,000	.0050	.0001	
55,000	.0055	.0001	
60,000	.0060	.0001	
64,000	.0068	....	Elastic limit, approximate.
65,000	.0084	....	
66,000	.0105	....	
67,000	.0112	....	
68,000	.0135	....	
69,000	.0137	....	
70,000	.0142	....	
71,000	.0154	....	
73,000	.0169	....	
75,000	.0188	....	
76,000	.0207	....	
78,000	.0224	....	
80,000	.0248	....	
90,000	.0375	....	
100,000	.0518	....	
110,000	.0689	....	
120,000	.0918	....	
130,000	.1230	....	
132,000	.1305	....	
134,000	.1570	....	
136,000	.16	....	
138,000	.17	....	
140,000	.20	....	
142,000	....	....	Tensile strength.
0	.23	....	=7.7 per cent elongation in 3″.

Elongation of inch sections, ″.09, ″.08*, ″.06.
Diameter at fracture, ″.53; area, .2206 square inch.
Contraction of area, 11.8 per cent.
Fractured 1″.20 from the neck.
Appearance of fracture, fine granular.

No. 8844.

Marks, 1.09 C405.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0019	....	
30,000	.0029	0.	
35,000	.0035	0.	
40,000	.0040	0.	
45,000	.0062	.0021	
50,000	.0073	.0021	
55,000	.0078	.0021	
60,000	.0085	.0021	
65,000	.0091	.0022	
70,000	.0098	.0023	
71,000	.0103	....	Elastic limit, approximate.
73,000	.0150	....	
75,000	.0327	....	
76,000	.0340	....	
77,000	.0348	....	
78,000	.0355	....	
80,000	.0373	....	
90,000	.0500	....	
100,000	.0661	....	
110,000	.0840	....	
120,000	.1135	....	
124,000	.13	....	
128,000	.16	....	
132,000	.20	....	
134,400	....	....	Tensile strength.
0	.24	....	=8 per cent elongation in 3″.

Elongation of inch sections, ″.07, ″.08, ″.09*.
Diameter at fracture, ″.53; area, .2206 square inch.
Contraction of area, 11.8 per cent.
Fractured ″.75 from the neck.
Appearance of fracture, fine granular.

No. 8845.

Marks, .17 C1. Annealed.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0002	0.	
10,000	.0008	....	
20,000	.0020	....	
30,000	.0031	− .0001	
35,000	.0036	− .0001	
40,000	.0042	− .0001	
42,000	.0043	....	
43,000	.0044	....	Elastic limit.
44,000	.0872	....	
45,000	.0897	....	
46,000	.0932	....	
47,000	.1017	....	
48,000	.1125	....	
49,000	.1205	....	
50,000	.1275	....	
52,000	.14	....	
54,000	.17	....	
56,000	.20	....	
58,000	.23	....	
60,000	.29	....	
62,000	.36	....	
63,000	.43	....	
64,000	.61	....	
64,800	....	....	Tensile strength.
0	1.06	....	=35.3 per cent elongation in 3″.

Elongation of inch sections, ″.25, ″.57*, ″.24
Diameter at fracture, ″.35; area, .0962 square inch.
Contraction of area, 61.5 per cent.
Fractured at middle of stem.
Appearance of fracture, fine silky.

No. 8846.

Marks, .17 C2. Annealed.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0020	....	
30,000	.0030	.0002	
35,000	.0036	.0002	
40,000	.0041	.0002	
45,000	.0045	.0002	
50,000	.0050	.0002	
51,000	.0051	....	
52,000	.0052	....	Elastic limit.
53,000	.0743	....	
54,000	.0745	....	
55,000	.0796	....	
56,000	.0817	....	
57,000	.0878	....	
58,000	.0955	....	
59,000	.1090	....	
60,000	.1130	....	
62,000	.1320	....	
64,000	.1570	....	
66,000	.17	....	
68,000	.20	....	
70,000	.24	....	
72,000	.30	....	
73,000	.34	....	
74,000	.42	....	
74,800	....	....	Tensile strength.
0	.80	....	=26.6 per cent elongation in 3″.

Elongation of inch sections, ″.21, ″.14, ″.45*.
Diameter at fracture, ″.33; area, .0855 square inch.
Contraction of area, 65.8 per cent.
Fractured ″.70 from the neck.
Appearance of fracture, fine silky.

No. 8847.

Marks, .17 C3. Annealed.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0017	....	
30,000	.0028	0.	
35,000	.0033	0.	
40,000	.0038	0.	
45,000	.0044	0.	
50,000	.0049	.0001	
51,000	.0051	....	
52,000	.0052	....	
53,000	.0055	....	Elastic limit.
54,000	.0059 .0450	....	
55,000	.0472	....	
56,000	.0490	....	
57,000	.0545	....	
58,000	.0600	....	
59,000	.0665	....	
60,000	.0708	....	
65,000	.1022	....	
70,000	.1500	....	
72,000	.1800	....	
74,000	.21	....	
76,000	.28	....	
77,000	.35	....	
77,600	....	....	Tensile strength.
0	.63	....	=21 per cent elongation in 3''

Elongation of inch sections, ''.44*, ''.11, ''.08.
Diameter at fracture, ''.34; area, .0908 square inch.
Contraction of area, 63.7 per cent.
Fractured ''.90 from the neck.
Appearance of fracture, fine silky.

No. 8849.

Marks, .17 C5. Annealed.
Diameter, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0009	....	
20,000	.0021	....	
30,000	.0032	.0001	
35,000	.0037	.0001	
40,000	.0042	.0001	
42,000	.0043	....	
44,000	.0045	....	
45,000	.0047	....	Elastic limit.
46,000	.0115	....	
47,000	.0798	....	
48,000	.0827	....	
49,000	.1155	....	
50,000	.1203	....	
51,000	.1325	....	
52,000	.1450	....	
53,000	.1550	....	
54,000	.1660	....	
56,000	.19	....	
58,000	.22	....	
60,000	.28	....	
62,000	.33	....	
64,000	.45	....	
65,000	.55	....	
66,000	....	....	Tensile strength.
0	.96	....	=32 per cent elongation in 3''.

Elongation of inch sections, ''.50*, ''.23, ''.23.
Diameter at fracture, ''.34; area, .0908 square inch.
Contraction of area, 63.7 per cent.
Fractured 1'' from the neck.
Appearance of fracture, fine silky.

No. 8851.

Marks, .34 C412.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008		
20,000	.0018		
30,000	.0030	0.	
35,000	.0035	0.	
40,000	.0040	0.	
45,000	.0045	0.	
50,000	.0050	0.	
55,000	.0056		Elastic limit.
56,000	.0665		
57,000	.0708		
58,000	.0734		
59,000	.0781		
60,000	.0822		
65,000	.1097		
70,000	.1450		
75,000	.2040		
78,000	.24		
80,000	.28		
82,000	.36		
83,000	.44		
84,000			Tensile strength.
0	.83		=27.7 per cent elongation in 3″.

Elongation of inch sections, ″.19, ″.44*, ″.20.
Diameter at fracture, ″.39; area, .1194 square inch.
Contraction of area, 52.2 per cent.
Fractured at middle of stem.
Appearance of fracture, fine silky.

No. 8852.

Marks, T 65411.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008	....	
20,000	.0022	....	
30,000	.0033	0.	
35,000	.0039	.0001	
40,000	.0046	.0002	
45,000	.0054	.0005	
50,000	.0062	.0008	
51,000	.0065	....	
52,000	.0067	....	
53,000	.0070	....	
54,000	.0072	....	
55,000	.0076	.0017	
56,000	.0080	....	
57,000	.0083	....	
58,000	.0092	....	
59,000	.0096	....	
60,000	.0100	.0034	
61,000	.0104	....	
62,000	.0109	....	
63,000	.0115	....	
64,000	.0124	....	
65,000	.0134	.0062	
66,000	.0147	....	
67,000	.0156	....	
68,000	.0171	....	
69,000	.0188	....	
70,000	.0199	.0122	
72,000	.0228	....	
74,000	.0252	....	
76,000	.0298	....	
78,000	.0346	....	
80,000	.0385	....	
82,000	.0438	....	
85,000	.05	....	
90,000	.06	....	
95,000	.08	....	
100,000	.10	....	
105,000	.11	....	
106,000	.12	....	
108,000	.13	....	
110,000	.14	....	
112,000	.16	....	
114,000	.19	....	
116,000	.22	....	
118,000	.28	....	
119,600	....	....	Tensile strength.
0	.48	....	=16 per cent elongation in 3″.

Elongation of inch sections, ″.10, ″.20*, ″.18.
Diameter at fracture, ″.46; area, .1662 square inch.
Contraction of area, 33.5 per cent.
Fractured 1″.40 from the neck.
Appearance of fracture, silky.
Elastic limit not well defined.

No. 8853.

Marks, W 1418.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads per square inch.	In gauged length.		Remarks.
	Elongation.	Set.	
Pounds.	*Inch.*	*Inch.*	
1,000	0.	0.	Initial load.
5,000	.0003	0.	
10,000	.0008		
20,000	.0018		
30,000	.0028	0.	
35,000	.0034	— .0001	
40,000	.0040	— .0001	
45,000	.0043	— .0001	
50,000	.0047	— .0002	
55,000	.0053	— .0003	
60,000	.0058	— .0003	
65,000	.0065	— .0003	
70,000	.0071	— .0003	
75,000	.0077	— .0003	
80,000	.0082	— .0002	
85,000	.0088		
90,000	.0094	— .0001	
95,000	.0100		
100,000	.0108	.0002	
105,000	.0115		
110,000	.0122	.0004	
115,000	.0133		
120,000	.0140	.0009	
125,000	.0151		
130,000	.0158	.0017	
135,000	.0169		
140,000	.0182	.0026	
145,000	.0190		
146,000	.0192		
148,000	.0199		
150,000	.0207	.0042	
152,000	.0213		
154,000	.0218		
156,000	.0228		
158,000	.0238		
160,000	.0250	.0074	
162,000	.0263		
164,000	.0273		
166,000	.0313		
168,000	.0324		
170,000	.0332	.0140	
172,000	.0350		
174,000	.0359		
176,000	.0382		
178,000	.0425		
180,000	.0456	.0252	
182,000	.0491		
184,000	.0542		
186,000	.0610		
188,000	.07		
189,000	.08		
190,400			Tensile strength.
0	.25		=8.3 per cent elongation in 3″.

Elongation of inch sections, ″.02, ″.21*, ″.02.
Diameter at fracture, ″.44; area, .1521 square inch.
Contraction of area, 39.2 per cent.
Fractured in center.
Appearance of fracture, silky.

TABULATION OF TENSILE TESTS OF SPECIMENS FROM ENDS OF ENDURANCE SHAFTS.

Diameter of specimens, ''.564.
Sectional area, .25 square inch.
Gauged length, 3''.

No. of test.	Marks.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Elongation of inch sections.			Appearance of fracture.
		Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	''	''	''	
8809	C370	43,000	60,000	21.0	49.7	.13	.17	.33*	Fibrous, seams along stem.
8810	.17 C371	50,000	70,800	31.7	57.0	.22	.48*	.25	Fine silky.
8811	.17 C372	44,000	70,800	31.7	57.0	.23	.51*	.21	Do.
8812	.17 C373	51,000	70,800	32.0	57.0	.21	.51*	.24	Do.
8813	.17 C374	46,000	70,800	32.0	57.0	.24	.50*	.22	Do.
8814	.17 C375	47,000	70,400	32.3	57.0	.23	.51*	.23	Do.
8815	.17 C376	45,000	70,400	32.3	57.0	.22	.52	.23	Fine silky, cup shaped.
8816	.55 C377	56,000	110,800	16.7	30.6	.12	.15	.23*	Fine granular 50 per cent, silky 50 per cent.
8817	.55 C378		110,800	18.3	30.6	.14	.27*	.14	Silky 85 per cent, granular 15 per cent.
8818	.55 C379	57,000	110,800	18.3	33.5	.14	.27*	.14	Do.
8819	.55 C380	57,000	110,800	18.3	30.6	.13	.15	.17	Do.
8820	.55 C381	56,000	110,800	18.3	30.6	.15	.27*	.13	Do.
8821	.73 C417	65,000	140,800	11.3	18.3	.13	.11	.10	Fine granular.
8822	.82 C382	65,000	142,000	9.3	11.8	.08	.12*	.08	Do.
8823	.82 C384	65,000	140,000	8.3	8.4	.08	.10*	.07	Do.
8824	.82 C386	65,000	145,200	8.7	8.4	.08	.10*	.08	Do.
8843	.82 C387	64,000	142,000	7.7	11.8	.09	.08*	.06	Do.
8844	1.09 C405	71,000	134,400	8.0	11.8	.07	.08	.09*	Do.
8845	.17 C1[a]	43,000	64,800	35.3	61.5	.25	.57*	.24	Fine silky.
8846	.17 C2[a]	52,000	74,800	26.6	65.8	.21	.14	.45*	Do.
8847	.17 C3[a]	53,000	77,600	21.0	63.7	.44*	.11	.08	Do.
8849	.17 C5[a]	45,000	66,000	32.0	63.7	.50*	.23	.23	Do.
8851	.34 C412	55,000	84,000	27.7	52.2	.19	.44*	.20	Do.
8852	T 65411		119,600	16.0	33.5	.10	.20*	.18	Silky.
8853	W 1418		190,400	8.3	39.2	.02	.21*	.02	Do.

[a] Annealed.

TESTS OF BUILDING STONE.

TESTS FOR COMPRESSIVE ELASTIC PROPERTIES OF BUILDING STONE, FURNISHED BY THE WEST VIRGINIA GEOLOGICAL SURVEY.

1. Samples for compressive elastic properties herewith reported were in the form of prisms measuring approximately 24 inches long by 4 inches by 6 in cross-section dimensions. The samples were finished for testing on a rubbing bed. Compression observations were made by means of a compressometer covering a gauged length of 20 inches of the stone, this gauged length occupying a position equidistant from the ends of the sample. The samples were adjusted in the testing machine, so that the loads were evenly distributed over the ends of the samples and an initial load of 100 pounds per square inch applied, at which time the reading of the compressometer was set at zero point. Loads were advanced with increments of 100 pounds per square inch. The compression of the stones was determined under each increment of load and the permanent sets determined by releasing the loads and returning to the initial load of 100 pounds. Loads were advanced in this way until a maximum was reached beyond which it did not seem prudent to pass. This maximum load was kept well within the ultimate resistance of the stone in order to preserve the sample for subsequent tests which have been requested by the survey.

2. The modulus of elasticity has been computed for each sample, and for the sake of uniformity the same range of stress was used in each case. The range of stress chosen was from 1,000 to 3,000 pounds per square inch. In computing the modulus of elasticity, the permanent sets were deducted—that is, the value of the modulus depends upon the resilience of the material as here given. After the samples had been loaded with higher loads, observations were made on their behavior over a lower range of stress. When these latter observations were made the compression of the sample was observed under ascending stresses and the successive lengths measured as the stone recoverd in length under diminishing stresses. It will be noticed that the lengths of the samples were different under the same load according to whether the series of loadings was an ascending or a descending one, and, furthermore, that the rate of compressibility varied both under ascending and descending stresses. This behavior is common to softer stones.

3. The stones immediately respond to any change of stress whether loading or unloading and nearly the full amount of compression or resilience is immediately developed. Under sustained loads of a few minutes' duration a slight additional compression of the material occurs. Observations to show these features were made in the case of one of the samples herewith reported, the observations showing the behavior both under increasing and decreasing stresses. The development of early permanent sets and their progressive increase was a feature generally shown by all the samples.

No. 1252.

Sample from C. D. Merrick and J. P. Whealdon, Parkersburg, W. Va.
Weight, 47¼ pounds = 142.4 pounds per cubic foot.
Length, 23''.92.
Sectional area, 3''.98 × 6''.02 = 23.96 square inches.
Gauged length, 20 inches.
Color, blue.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,396	100	0.	0.	Initial load.
4,792	200	.0017		
7,188	300	.0042	.0019	
9,584	400	.0071	.0029	
11,980	500	.0097	.0038	
14,376	600	.0126	.0051	
16,772	700	.0154	.0059	
19,168	800	.0179	.0070	
21,564	900	.0202	.0076	
23,960	1,000	.0219	.0085	
26,356	1,100	.0239	.0092	
28,752	1,200	.0257	.0096	
31,148	1,300	.0275	.0102	
33,544	1,400	.0293	.0108	
35,940	1,500	.0310	.0113	
38,336	1,600	.0325	.0117	
40,732	1,700	.0343	.0121	
43,128	1,800	.0362	.0125	
45,524	1,900	.0374	.0130	
47,920	2,000	.0391	.0131	
50,316	2,100	.0407	.0135	
52,712	2,200	.0423	.0140	
55,108	2,300	.0437	.0145	
57,504	2,400	.0450	.0149	
59,900	2,500	.0462	.0152 .0149	Set after 2 minutes' rest
	200	.0161		
	400	.0191		
	600	.0221		
	800	.0252		
	1,000	.0282		
	1,200	.0311		
	1,400	.0338		
	1,600	.0361		
	1,800	.0386		
	2,000	.0411		
	1,800	.0397		
	1,600	.0381		
	1,400	.0363		
	1,200	.0343		
	1,000	.0320		
	800	.0295		
	600	.0261		
	400	.0226		
	200	.0181	.0154 .0152	After 2 minutes' rest.
				Rested under initial load 1 hour.
62,296	2,600	.0472	.0154	
64,692	2,700	.0483	.0160	
67,088	2,800	.0499	.0163	
69,484	2,900	.0512	.0167	
71,880	3,000	.0526	.0169	E (1,000 to 3,000) 1,794,000 pounds per square inch.
74,276	3,100	.0541	.0173	
76,672	3,200	.0553	.0177	
79,068	3,300	.0569	.0179	
81,464	3,400	.0583	.0181	
83,860	3,500	.0593	.0184	
	200	.0195		
	400	.0222		
	800	.0292		
	1,200	.0352		
	1,600	.0406		

No. 1252—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
	2,000	.0451		
	1,600	.0425		
	1,200	.0379		
	800	.0326		
	400	.0259		
	200	.0212	.0186	

Test discontinued.
Prism not ruptured.

No. 1253.

Brown sandstone from James D. Crump, Alderson, W. Va.
Weight, 50½ pounds = 153.3 pounds per cubic foot.
Length, 23″.90.
Sectional area, 3″.99 × 5″.97 = 23.82 square inches.
Gauged length, 20 inches.
Color, brown.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,382	100	0.	0.	Initial load.
4,764	200	.0002		
7,146	300	.0006		
9,528	400	.0011		
11,910	500	.0015	0.	
14,292	600	.0021		
16,674	700	.0027		
19,056	800	.0036		
21,438	900	.0042		
23,820	1,000	.0051	.0008	
35,730	1,500	.0091		
47,640	2,000	.0132	.0027	
59,550	2,500	.0176		
71,460	3,000	.0208	.0046	E (1,000 to 3,000) 3,361,000 pounds per square inch.
83,370	3,500	.0242		
95,280	4,000	.0278	.0060	
	200	.0063		
	400	.0070		
	800	.0090		
	1,000	.0100		
	1,500	.0135		
	2,000	.0170		
	1,500	.0146		
	1,000	.0118		
	800	.0105		
	400	.0079		
	200	.0066	.0061	
	100		.0056	Rested under 500 pounds per square inch 14 hours.
95,280	4,000	.0280	.0061	
107,190	4,500	.0317		
119,100	5,000	.0351	.0073	
131,010	5,500	.0388		
142,920	6,000	.0421	.0088	
154,830	6,500	.0450		
166,740	7,000	.0480	.0101	

No. 1253—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
178,650	7,500	.0514		
190,560	8,000	.0542	.0115	
202,470	8,500	.0575		
214,380	9,000	.0608	.0127	
226,290	9,500	.0645		
238,200	10,000	.0677	.0144	
			.0141	Set after 2 minutes' rest.
			.0136	Set after 20 minutes' rest.
	1,000	.0180		
	2,000	.0238		
	3,000	.0303		
	4,000	.0365		
	5,000	.0428		
	4,000	.0386		
	3,000	.0337		
	2,000	.0278		
	1,000	.0212	.0141	
	1,000	.0186		
	2,000	.0246		
	3,000	.0308		
	4,000	.0370		
	5,000	.0427		
	6,000	.0473		
	7,000	.0526		
	8,000	.0577		
	7,000	.0541		
	6,000	.0501		
	5,000	.0461		
	4,000	.0418		
	3,000	.0360		
	2,000	.0296		
	1,000	.0219	.0148	
			.0136	Set after resting 2 hours.
	1,000	.0181		
	2,000	.0240		
	2,000	.0242		After 5 minutes.
	3,000	.0305		
	4,000	.0367		
	4,000	.0371		After 5 minutes.
	5,000	.0427		
	6,000	.0476		
	6,000	.0478		After 5 minutes.
	6,000	.0480		After 10 minutes.
	7,000	.0525		
	8,000	.0577		
	8,000	.0581		After 5 minutes.
	8,000	.0582		After 10 minutes.
	8,000	.0582		After 15 minutes.
	8,000	.0582		After 20 minutes
	7,000	.0547		
	6,000	.0507		
	6,000	.0506		After 5 minutes.
	6,000	.0506		After 10 minutes.
	5,000	.0466		
	4,000	.0423		
	4,000	.0419		After 5 minutes.
	4,000	.0418		After 10 minutes.
	3,000	.0366		
	2,000	.0302		
	2,000	.0298		After 5 minutes.
	2,000	.0298		After 10 minutes.
	1,000	.0227		
	100		.0150	
	100		.0145	After 5 minutes.
	100		.0143	After 10 minutes.
	100		.0143	After 15 minutes.
	100		+.0142	After 20 minutes.

Test discontinued.

No. 1254.

Brown sandstone from Georges Creek Coal and Iron Company, Underwood, W. Va.

Weight, 45¼ pounds = 138.7 pounds per cubic foot.

Length, 23''.80.

Sectional area, 3''.96 × 5''.98 = 23.68 square inches.

Gauged length, 20 inches.

Color, brown.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,368	100	0.	....	Initial load.
4,736	200	.0015	.0005	
7,104	300	.0027	.0010	
9,472	400	.0043	.0015	
11,840	500	.0058	.0019	
14,208	600	.0073	.0024	
16,576	700	.0088	.0028	
18,944	800	.0102	.0032	
21,312	900	.0116	.0036	
23,680	1,000	.0131	.0039	
26,048	1,100	.0142	.0043	
28,416	1,200	.0155	.0045	
30,784	1,300	.0169	.0049	
33,152	1,400	.0181	.0051	
35,520	1,500	.0190	.0052	
37,888	1,600	.0202	.0055	
40,256	1,700	.0214	.0058	
42,624	1,800	.0226	.0061	
44,992	1,900	.0236	....	
47,360	2,000	.0248	.0065	
49,728	2,100	.0257	....	
52,096	2,200	.0267	....	
54,464	2,300	.0276	....	
56,832	2,400	.0286	....	
59,200	2,500	.0296	.0075	
61,568	2,600	.0308	....	
63,936	2,700	.0319	....	
66,304	2,800	.0326	....	
68,672	2,900	.0335	....	
71,040	3,000	.0344	.0085	E (1,000 to 3,000) 2,395,000 pounds per square inch.
73,408	3,100	.0356	....	
75,776	3,200	.0364	....	
78,144	3,300	.0372	....	
80,512	3,400	.0381	....	
82,880	3,500	.0390	.0094	
85,248	3,600	.0402	....	
87,616	3,700	.0410	....	
89,984	3,800	.0418	....	
92,352	3,900	.0428	....	
94,720	4,000	.0436	.0103	
....	200	.0112	....	
....	400	.0134	....	
....	600	.0157	....	
....	800	.0180	....	
....	1,000	.0202	....	
....	1,200	.0221	....	
....	1,400	.0240	....	
....	1,600	.0258	....	
....	1,800	.0276	....	
....	2,000	.0292	....	
....	1,800	.0279	....	
....	1,600	.0266	....	
....	1,400	.0251	....	
....	1,200	.0236	....	
....	1,000	.0219	....	
....	800	.0199	....	
....	600	.0177	....	
....	400	.0151	....	
....	200	.0119	.0104	

Test discontinued.

No. 1255.

Blue sandstone from Georges Creek Coal and Iron Company, Underwood, W. Va.

Weight, 47¾ pounds = 143.9 pounds per cubic foot.
Length, 23″.95.
Sectional area, 3″.97 × 6″.03 = 23.94 square inches.
Gauged length, 20 inches.
Color, blue.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch*	*Inch.*	
2,394	100	0.	0.	Initial load.
4,788	200	.0017	.0006	
7,182	300	.0040	.0015	
9,576	400	.0064	.0026	
11,970	500	.0088	.0036	
14,364	600	.0110	.0045	
16,758	700	.0133	.0055	
19,152	800	.0152	.0060	
21,546	900	.0171	.0070	
23,940	1,000	.0186	.0073	
26,334	1,100	.0203	.0077	
28,728	1,200	.0219	.0084	
31,122	1,300	.0233	.0088	
33,516	1,400	.0247	.0094	
35,910	1,500	.0263	.0098	
38,304	1,600	.0272	.0100	
40,698	1,700	.0283	.0102	
43,092	1,800	.0294	.0107	
45,486	1,900	.0306	....	
47,880	2,000	.0315	.0112	.0100. Set after resting 40 hours.
50,274	2,100	.0311	....	
52,668	2,200	.0320	....	
55,062	2,300	.0327	....	
57,456	2,400	.0335	....	
59,850	2,500	.0346	.0111	
62,244	2,600	.0356	....	
64,638	2,700	.0364	....	
67,032	2,800	.0373	....	
69,426	2,900	.0381	....	
71,820	3,000	.0389	.0118	E (1,000 to 3,000) 2,532,000 pounds per square inch.
74,214	3,100	.0400	....	
76,608	3,200	.0407	....	
79,002	3,300	.0413	....	
81,396	3,400	.0421	....	
83,790	3,500	.0431	.0127	
86,184	3,600	.0440	....	
88,578	3,700	.0447	....	
90,972	3,800	.0454	....	
93,366	3,900	.0461	....	
95,760	4,000	.0468	.0134	
....	200	.0143	....	
....	400	.0168	....	
....	600	.0195	....	
....	800	.0217	....	
....	1,000	.0239	....	
....	1,200	.0259	....	
....	1,400	.0278	....	
....	1,600	.0297	....	
....	1,800	.0313	....	
....	2,000	.0329	....	
....	1,800	.0318	....	
....	1,600	.0305	....	
....	1,400	.0291	....	
....	1,200	.0276	....	
....	1,000	.0259	....	
....	800	.0240	....	
....	600	.0218	....	
....	400	.0190	....	
....	200	.0157	.0136	

Test discontinued.

No. 1256.

Sandstone from the Coal and Coke Railway, Gassaway, W. Va.
Weight, 45 pounds = 151.6 pounds per cubic foot.
Length, 23''.85.
Sectional area, 3''.74 × 5''.75 = 21.51 square inches.
Gauged length, 20 inches.
Color, blue.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,151	100	0.	0.	Initial load.
4,302	200	.0010	.0004	
6,453	300	.0030	.0011	
8,604	400	.0050	.0020	
10,755	500	.0071	.0027	
12,906	600	.0093	.0036	
15,057	700	.0117	.0046	
17,208	800	.0141	.0053	
19,359	900	.0161	.0061	
21,510	1,000	.0183	.0068	
23,661	1,100	.0204	.0075	
25,812	1,200	.0222	.0081	
27,963	1,300	.0241	.0086	
30,114	1,400	.0261	.0094	
32,265	1,500	.0276	.0098	
34,416	1,600	.0293	.0103	
36,567	1,700	.0308	.0108	
38,718	1,800	.0323	.0112	
40,869	1,900	.0340	....	
43,020	2,000	.0350	.0114	
45,171	2,100	.0366	....	
47,322	2,200	.0378	....	
49,473	2,300	.0390	....	
51,624	2,400	.0401	....	
53,775	2,500	.0413	.0132	
55,926	2,600	.0428	....	
58,077	2,700	.0439	....	
60,228	2,800	.0449	....	
62,379	2,900	.0458	....	
64,530	3,000	.0469	.0145	E (1,000 to 3,000) 1,914,000 pounds per square inch.
66,681	3,100	.0481	....	
68,832	3,200	.0490	....	
70,983	3,300	.0499	....	
73,134	3,400	.0508	....	
75,285	3,500	.0518	.0155	

Test discontinued.

No. 1257.

Sandstone from Elkins (?).
Weight, 43¾ pounds = 138.4 pounds per cubic foot
Length, 23''.75.
Sectional area, 4'' × 5''.75 = 23 square inches.
Gauged length, 20 inches.
Color, brown.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,300	100	0.	0.	Initial load.
4,600	200	.0031	.0018	
6,900	300	.0061	.0033	
9,200	400	.0089	.0045	
11,500	500	.0118	.0057	
13,800	600	.0141	.0067	
16,100	700	.0163	.0076	
18,400	800	.0186	.0084	
20,700	900	.0207	.0091	
23,000	1,000	.0225	.0099	
25,300	1,100	.0243	.0103	
27,600	1,200	.0260	.0107	
29,900	1,300	.0278	.0113	
32,200	1,400	.0294	.0120	
34,500	1,500	.0310	.0124	
36,800	1,600	.0326	.0131	
39,100	1,700	.0341	.0134	
41,400	1,800	.0355	.0138	
43,700	1,900	.0369	.0143	
46,000	2,000	.0384	.0147	
48,300	2,100	.0397	....	
50,600	2,200	.0406	....	
52,900	2,300	.0418	....	
55,200	2,400	.0431	....	
57,500	2,500	.0441	.0156	
59,800	2,600	.0456	....	
62,100	2,700	.0468	....	
64,400	2,800	.0477	....	
66,700	2,900	.0489	....	
69,000	3,000	.0498	.0165	E (1,000 to 3,000) 1,932,000 pounds per square inch.
71,300	3,100	.0514	....	
73,600	3,200	.0523	....	
75,900	3,300	.0533	....	
78,200	3,400	.0542	....	
80,500	3,500	.0552	.0177	
....	200	.0192	....	
....	400	.0229	....	
....	600	.0262	....	
....	800	.0290	....	
....	1,000	.0316	....	
....	1,200	.0340	....	
....	1,400	.0363	....	
....	1,600	.0384	....	
....	1,800	.0404	....	
....	2,000	.0424	....	
....	1,800	.0411	....	
....	1,600	.0396	....	
....	1,400	.0379	....	
....	1,200	.0361	....	
....	1,000	.0340	....	
....	800	.0316	....	
....	600	.0289	....	
....	400	.0255	....	
....	200	.0210	.0178	

Test discontinued.

CONCRETE COLUMNS.

PLAIN AND REENFORCED.

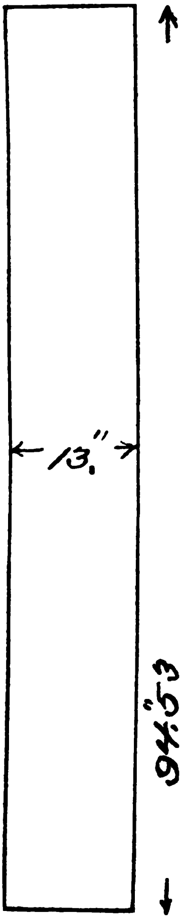
No. 2058.

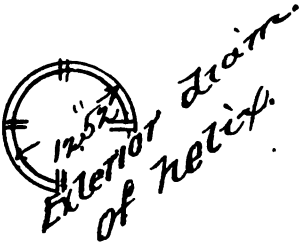
1:3:3 mixture.

Reenforced by means of wire helix, the pitch of which was regulated by four longitudinal spacing bars. Diameter of wire in helix, ″.39.

Pitch 1″.

Cage furnished by Edgar D. Martin, of Richard E. Schmidt, Garden & Martin.





No. 2058.

Composition, by volume: Saylor's Portland cement, 1; sand, 3; trap rock (⅛″ to ½″), 3.
Age, set in air, 1 year 7 months 19 days.
Weight of column, total, 1,183½ pounds.
Weight of concrete, 924½ pounds = 137.3 pounds per cubic foot.
Weight of cage, complete, 259 pounds.
Height of column, 94.53 inches.
Diameter of column, 13 inches.
Sectional area, gross, 132.73 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
13,273	100	0.	0.	{Initial load. {Loaded with 11,000 pounds before testing.
19,910	150	.0005	0.	
26,546	200	.0013	0.	
33,183	250	.0023	.0002	
39,820	300	.0035	.0003	
46,456	350	.0049	.0003	
53,092	400	.0064	.0005	
59,729	450	.0075	.0006	
66,365	500	.0090	.0008	
73,002	550	.0107	.0009	
79,638	600	.0121	.0011	
....	600	.0122	.0011	
86,275	650	.0135	....	
92,911	700	.0148	....	
99,548	750	.0162	....	
106,184	800	.0173	....	
112,821	850	.0185	....	
119,457	900	.0200	....	

No. 2058—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
126,094	950	.0212	....	
132,730	1,000	.0225	.0018	
79,638	600	.0141	.0019	
....	600	.0143	.0020	Rested under initial load 16 hours.
146,003	1,100	.0252	....	
159,276	1,200	.0277	....	
172,549	1,300	.0301	....	
185,822	1,400	.0325	....	
199,095	1,500	.0348	.0031	
79,638	600	.0165	.0033	
....	600	.0164	.0034	
212,368	1,600	.0378	....	
225,641	1,700	.0402	....	
238,914	1,800	.0429	....	
252,187	1,900	.0454	....	
265,460	2,000	.0482	.0052	
79,638	600	.0193	.0052	
....	600	.0193	.0052	
278,733	2,100	.0512	....	
292,006	2,200	.0535	....	
305,279	2,300	.0566	....	
318,552	2,400	.0625	....	
331,825	2,500	.0680	.0182	
79,368	600	.0323	.0182	
....	600	.0323	.0182	
345,098	2,600	.0786	....	
358,371	2,700	.0858	....	
371,644	2,800	.0930	....	
384,917	2,900	.1025	....	
398,190	3,000	.1118	.0556	
79,638	600	.0663	.0557	
....	600	.0662	.0557	
411,463	3,100	.1247	....	
424,736	3,200	.1363	....	
438,009	3,300	.1430	....	
451,282	3,400	.1553	....	
464,555	3,500	.1642	.1013	
79,638	600	.1095	.1005	
....	600	.1095	.1006	
477,828	3,600	.1820	....	
491,101	3,700	.1927	....	
504,374	3,800	.2065	....	
517,647	3,900	.2125	....	
530,920	4,000	.2273	.1603	
79,638	600	.1683	.1596	
....	600	.1683	.1595	
544,193	4,100	.2471	....	
557,466	4,200	.2619	....	
570,739	4,300	.2760	....	
584,012	4,400	.2884	.2161	
79,638	600	.2230	.2144	
....	600	.2230	.2144	
752,100	5,666	....	....	Ultimate strength.

Column failed at upper end. There was 1″ of concrete at this end above the helix and the longitudinal spacing bars. At lower end the helix and spacing bars were flush with the end of the column. Column deflected laterally, opening oblique shearing cracks between pitches of the helix, which were most pronounced on the concave side.

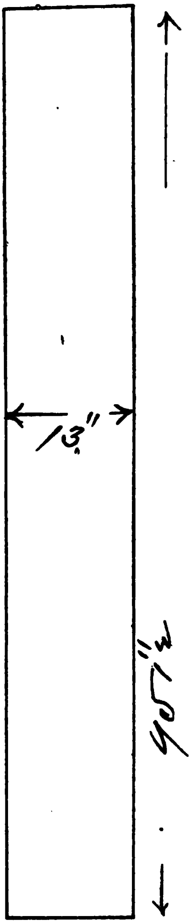
No. 2059.

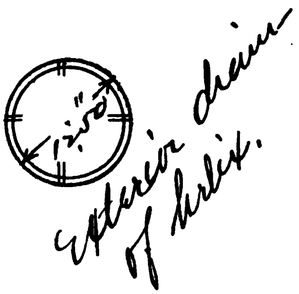
1:3 mixture.

Reenforced by means of wire helix, the pitch of which was regulated by four longitudinal spacing bars. Diameter of wire in helix, ″.39.

Pitch 1″.

Cage furnished by Edgar D. Martin of Richard E. Schmidt, Garden & Martin.





No. 2062.

Composition, by volume: Saylor's Portland cement, 1; sand, 3.
Age, set in air, 1 year 7 months 21 days.
Weight of column, total, 948 pounds.
Weight of concrete, 869 pounds = 123.0 pounds per cubic foot.
Weight of cage, 79 pounds.
Height of column, 94.05 inches.
Diameter of column, 13 inches.
Sectional area, gross, 132.73 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds	*Pounds.*	*Inch.*	*Inch.*	
13,273	100	0.	0.	Initial load. Loaded with 11,000 pounds before testing.
19,910	150	.0030	.0010	
26,546	200	.0058	.0017	
33,183	250	.0082	.0020	
39,820	300	.0106	.0023	
46,456	350	.0130	.0026	
53,092	400	.0152	.0028	
59,729	450	.0172	.0031	
66,365	500	.0191	.0032	
73,002	550	.0209	.0034	
79,638	600	.0228	.0037	
....	600	.0230	.0037	
86,275	650	.0244	....	
92,911	700	.0262	....	
99,548	750	.0279	....	
106,184	800	.0296	....	
112,821	850	.0315	....	
119,457	900	.0332	....	
126,094	950	.0351	....	
132,730	1,000	.0370	.0057	
79,638	600	.0260	.0057	
....	600	.0258	.0057	
146,003	1,100	.0409	....	
159,276	1,200	.0445	....	
172,549	1,300	.0493	....	
185,822	1,400	.0532	....	
199,095	1,500	.0577	.0135	
79,638	600	.0322	.0134	
....	600	.0322	.0135	
212,368	1,600	.0640	....	
225,641	1,700	.0703	....	
238,914	1,800	.0768	....	
252,187	1,900	.0845	....	
265,460	2,000	.0945	.0355	
79,638	600	.0523	.0352	
....	600	.0523	.0352	
278,733	2,100	.1159	.0657	Concrete flaked off at center.
79,638	600	.0835	.0650	
....	600	.0835	.0650	
480,100	3,617	....	....	Ultimate strength.

Column failed by triple flexure. Concrete flaked off outside of helix the entire length of column. Fractured four coils of the helix over the longitudinal spacing bar about 9″ from middle of length.

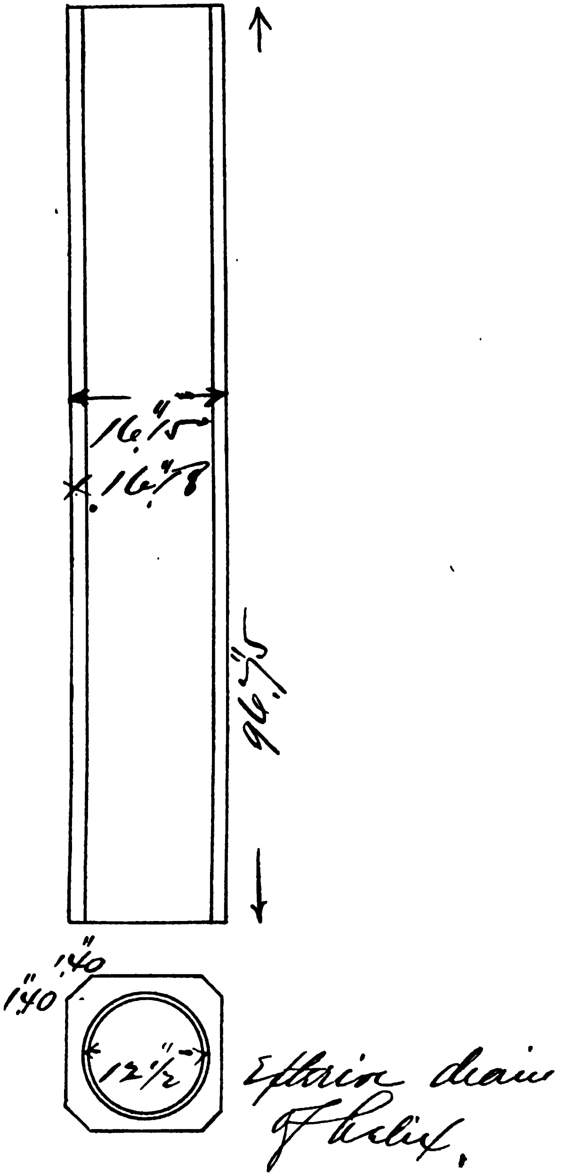
No. 2064.

1 : 2 : 3 mixture.

Reenforced by means of wire helix, the pitch of which was regulated by four longitudinal spacing bars. Diameter of wire in helix ″.40.

Pitch, 1″.

Column made in Chicago and forwarded to Watertown Arsenal by the F. P. Smith Wire and Iron Works under the direction of Mr. Edgar D. Martin.



No. 2064.

Composition, by volume: Portland cement, 1; torpedo sand, 2; washed gravel, 3.

Age, set in air, 1 year 2 months 19 days.

Weight of column, total, 2,267 pounds.

Height of column, 96.75 inches.

Sectional area, gross, 257.38 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
25,738	100	0.	0.	Initial load. Loaded with 15,000 pounds before testing.
38,607	150	.0004	—.0001	
51,476	200	.0008	—.0002	
64,345	250	.0012	—.0001	
77,214	300	.0015	—.0001	
90,083	350	.0019	—.0001	
102,952	400	.0023	—.0001	
115,821	450	.0028	—.0001	
128,690	500	.0033	0.	
141,559	550	.0039	0.	
154,428	600	.0045	0.	
....	600	.0045	.0001	
167,297	650	.0050	.0001	
180,166	700	.0055	.0002	
193,035	750	.0062	.0003	
205,904	800	.0068	.0003	
218,773	850	.0075	.0004	
231,642	900	.0081	.0004	
244,511	950	.0088	.0005	
257,380	1,000	.0095	.0007	
154,428	600	.0051	.0007	
....	600	.0052	.0007	
283,118	1,100	.0110	....	
308,856	1,200	.0123	....	
334,594	1,300	.0136	....	
360,332	1,400	.0148	....	
386,070	1,500	.0164	.0013	
154,428	600	.0062	.0013	
....	600	.0063	.0014	Rested under initial load 16 hours. Micrometer reset.
411,808	1,600	.0181	....	
437,546	1,700	.0198	....	
463,284	1,800	.0211	....	
489,022	1,900	.0228	....	
514,760	2,000	.0242	.0027	
154,428	600	.0078	.0026	
....	600	.0078	.0027	
540,498	2,100	.0258	....	
566,236	2,200	.0274	....	
591,974	2,300	.0290	....	
617,712	2,400	.0306	....	
643,450	2,500	.0323	.0042	
154,428	600	.0097	.0042	
....	600	.0097	.0040	
669,188	2,600	.0345	....	
694,926	2,700	.0362	....	
720,664	2,800	.0382	....	
746,402	2,900	.0402	....	
772,140	3,000	.0423	.0063	
154,428	600	.0126	.0063	
....	600	.0127	.0062	
797,878	3,100	.0457	.0076	
154,428	600	.0142	.0072	
....	600	.0142	.0072	
810,747	3,150	.0484	.0090	
....	600	.0160	.0088	
....	600	.0160	.0087	Test discontinued.

Column not fractured.

Sustained maximum load of the testing machine.

Reenforcing materials for columns of the Hennebique type was furnished by Mr. R. Baffrey, New York.

No. 2060.

1 : 2 : 4 mixture.

Hennebique type of reenforcement. Reenforced with four longitudinal, medium steel bars, 1½″ diameter each. Bars embraced by collars at intervals of 9″ and having grilles at each end of the column.

Composition by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock, (1½″ and smaller), 4. Water, 42.7 per cent of cement by weight.

Age, set in air, 2 years 2 months.

Weight of column, total, 1,816 pounds.

Weight of concrete, 1,609 pounds.

Weight of reenforcement, 207 pounds.

Height of column, 97.50 inches.

Sectional area of column, gross, 14″.20 by 13″.95 = 198.09 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,809	100	0.	0.	Initial load. Loaded with 10,800 pounds before testing
29,714	150	.0008	0.	
39,618	200	.0016	0.	
49,523	250	.0026	0.	
59,427	300	.0037	0.	
69,332	350	.0048	0.	
79,236	400	.0058	0.	
89,141	450	.0068	.0001	Micrometer reset.
99,045	500	.0082	.0002	
108,950	550	.0095	.0004	
118,854	600	.0109	.0006	
....	600	.0113	.0008	
128,759	650	.0125	....	
138,663	700	.0137	....	
148,568	750	.0150	....	
158,472	800	.0162	....	
168,377	850	.0173	....	
178,281	900	.0183	....	
188,186	950	.0193	....	
198,090	1,000	.0205	.0020	
118,854	600	.0139	.0020	
....	600	.0139	.0020	
217,899	1,100	.0237	....	
237,708	1,200	.0256	....	
257,517	1,300	.0278	....	
277,326	1,400	.0302	....	
297,135	1,500	.0326	.0052	
118,854	600	.0180	.0052	
....	600	.0181	.0052	
316,944	1,600	.0355	....	
336,753	1,700	.0379	....	
356,562	1,800	.0406	....	
376,371	1,900	.0432	....	
396,180	2,000	.0466	.0109	
118,854	600	.0242	.0109	
....	600	.0242	.0109	
415,989	2,100	.0512	....	
435,798	2,200	.0544	....	
455,607	2,300	.0579	....	
475,416	2,400	.0624	....	
495,225	2,500	.0672	.0234	
118,854	600	.0362	.0234	
....	600	.0362	.0234	
515,034	2,600	.0764	....	
534,843	2,700	.0823	....	
554,652	2,800	.0880	....	
574,461	2,900	.0990	....	

No. 2060—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
594,270	3,000	.1125	.0613	
118,854	600	.0729	.0605	
	600	.0723	.0605	
608,500	3,072	....	....	Ultimate strength.

Column failed at lower end. Opened oblique and longitudinal cracks 2 to 3 feet from the lower end of column.

No. 2065.

1 : 2 : 4 mixture.

Hennebique type of reenforcement. Reenforced with four longitudinal hard steel bars, 1½″ diameter each. Bars embraced by collars at intervals of 9″, and having grilles at each end of the column.

Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (1½″ and smaller), 4. Water, 42.7 per cent of cement, by weight.

Age, set in air, 2 years 2 months.

Weight of column, total, 1,825 pounds.

Weight of concrete, 1,618 pounds.

Weight of reenforcement, 207 pounds.

Height of column, 97″.20.

Sectional area of column, gross, 14″.17 by 13″.97 = 197.95 square inches.

Gauged length, .50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,795	100	0.	0.	{Initial load. {Loaded with 14,000 pounds before testing.
29,693	150	.0006	0.	
39,590	200	.0015	0.	
49,488	250	.0025	.0002	
59,385	300	.0035	.0003	
69,283	350	.0046	.0005	
79,180	400	.0059	.0005	
89,078	450	.0070	.0005	
98,975	500	.0083	.0006	
108,873	550	.0093	.0007	
118,770	600	.0104	.0008	
	600	.0104	.0008	
128,668	650	.0115	....	
138,565	700	.0125	....	
148,463	750	.0135	....	
158,360	800	.0145	....	
168,258	850	.0155	....	
178,155	900	.0165	....	
188,053	950	.0175	....	
197,950	1,000	.0185	.0012	
118,770	600	.0122	.0012	
....	600	.0122	.0012	Rested under initial load 16 hours. Micrometer reset.

No. 2065—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
217,745	1,100	.0211	....	
237,540	1,200	.0230	....	
257,335	1,300	.0248	....	
277,130	1,400	.0266	....	
296,925	1,500	.0285	.0027	
118,770	600	.0149	.0027	
....	600	.0149	.0027	
316,720	1,600	.0309	....	
336,515	1,700	.0325	....	
356,310	1,800	.0345	....	
376,105	1,900	.0364	....	
395,900	2,000	.0383	.0039	
118,770	600	.0170	.0039	
....	600	.0170	.0038	
415,695	2,100	.0417	....	
435,490	2,200	.0437	....	
455,285	2,300	.0457	....	
475,080	2,400	.0480	....	
494,875	2,500	.0502	.0058	
118,770	600	.0202	.0057	
....	600	.0202	.0057	
514,670	2,600	.0537	....	
534,465	2,700	.0560	....	
554,260	2,800	.0584	....	
574,055	2,900	.0614	....	
593,850	3,000	.0645	.0090	
118,770	600	.0245	.0089	
....	600	.0245	.0089	
613,645	3,100	.0715	....	
633,440	3,200	.0750	....	
653,235	3,300	.0791	....	
673,030	3,400	.0842	....	
692,825	3,500	.0913	.0250	
118,770	600	.0412	.0250	
....	600	.0412	.0250	
712,620	3,600	.1093	....	
732,415	3,700	.1160	....	
752,210	3,800	.1265	....	
768,000	3,880	....	.0779	Ultimate strength.
....	600	.0934	.0777	
....	600	.0935	.0780	

Column failed at lower end. Opened oblique and longitudinal cracks 16″ to 36″ from the lower end of column.

No. 2066.

1 : 2 : 4 mixture.

Hennebique type of reenforcement. Reenforced with four longitudinal medium steel bars, 1½″ diameter each. Bars embraced by collars at intervals of 9″, and having grilles at each end of the column.

Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (1½″ and smaller), 4. Water, 42.7 per cent of cement, by weight.

Age, set in air, 2 years 2 months.

Weight of column, total, 1,831 pounds.

Weight of concrete, 1,620 pounds.

Weight of reenforcement, 211 pounds.

Height of column, 97″.12.

Sectional area of column, gross, 14″.19 by 13″.94 = 197.81 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,781	100	0.	0.	Initial load. Loaded with 15,000 pounds before testing.
29,672	150	.0010	.0001	
39,562	200	.0020	.0003	
49,453	250	.0030	.0005	
59,343	300	.0042	.0005	
69,234	350	.0055	.0007	
79,124	400	.0066	.0007	
89,015	450	.0079	.0009	
98,905	500	.0090	.0009	
108,796	550	.0102	.0010	
118,686	600	.0111	.0009	
....	600	.0113	.0008	
128,577	650	.0120	.0005	
138,467	700	.0127	.0005	
148,358	750	.0138	.0005	
158,248	800	.0147	.0007	
168,139	850	.0158	.0008	
178,029	900	.0168	.0009	
187,920	950	.0179	.0010	
197,810	1,000	.0189	.0012	
118,686	600	.0130	.0012	
....	600	.0131	.0013	
217,591	1,100	.0210	....	
237,372	1,200	.0229	....	
257,153	1,300	.0245	....	
276,934	1,400	.0265	....	
296,715	1,500	.0285	.0027	
118,686	600	.0153	.0027	
....	600	.0153	.0027	
316,496	1,600	.0310	....	
336,277	1,700	.0330	....	
356,058	1,800	.0350	....	
375,839	1,900	.0369	....	
395,620	2,000	.0390	.0061	
118,686	600	.0189	.0061	
....	600	.0189	.0060	
415,401	2,100	.0425	....	
435,182	2,200	.0450	....	
454,963	2,300	.0474	....	
474,744	2,400	.0500	....	
494,525	2,500	.0525	.0127	
118,686	600	.0254	.0127	
....	600	.0254	.0127	Rested under initial load 16 hours. Micrometer reset.
514,306	2,600	.0581	....	
534,087	2,700	.0608	....	
553,868	2,800	.0640	....	
573,649	2,900	.0675	....	
593,430	3,000	.0715	.0245	
118,686	600	.0368	.0245	
....	600	.0368	.0245	
613,211	3,100	.0805	....	
632,992	3,200	.0845	....	
652,773	3,300	.0910	....	
672,554	3,400	.1070	.0540	
....	600	.0645	.0540	
....	600	.0645	.0540	
675,000	3,412	....	....	Ultimate strength.

Column failed at lower end. Opened oblique and longitudinal cracks 4″ to 36″ from the lower end of column.

No. 2067.

1:2:4 mixture.

Hennebique type of reenforcement. Reenforced with four longitudinal hard-steel bars 1¼″ diameter each. Bars embraced by collars at intervals of 9″ and having grilles at each end of the column.

Composition, by volume: Alpha cement, 1; sand (10-mesh sieve), 2; trap rock (1¼″ and smaller), 4. Water, 42.7 per cent of cement, by weight.

Age, set in air, 2 years 2 months.

Weight of column, total, 1,831 pounds.

Weight of concrete, 1,631 pounds.

Weight of reenforcement, 200 pounds.

Height of column, 97.12 inches.

Sectional area of column, gross 14″.18 by 13″.94=197.67 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,767	100	0.	0.	Initial load. Loaded with 15,000 pounds before testing.
29,651	150	.0007	0.	
39,534	200	.0015	.0002	
49,418	250	.0026	.0003	
59,301	300	0034	.0004	
69,185	350	0044	.0005	
79,068	400	.0053	.0005	
88,952	450	.0065	.0006	
98,835	500	.0076	.0008	
108,719	550	.0086	.0008	
118,602	600	.0096	.0010	
....	600	.0097	.0009	
128,486	650	.0107	....	
138,369	700	.0117	....	
148,253	750	.0127	....	
158,136	800	.0136	....	
168,020	850	.0146	....	
177,903	900	.0154	....	
187,787	950	.0163	....	
197,670	1,000	.0171	.0010	
118,602	600	.0109	.0009	
....	600	.0109	.0008	
217,437	1,100	.0186	....	
237,204	1,200	.0203	.0010	
256,971	1,300	.0220	....	
276,738	1,400	.0240	....	
296,505	1,500	.0256	.0016	
118,602	600	.0126	.0016	
....	600	.0126	.0016	
316,272	1,600	.0277	....	
336,039	1,700	.0292	....	
355,806	1,800	.0310	....	
375,573	1,900	.0326	....	
395,340	2,000	.0345	.0025	
118,602	600	.0142	.0025	
....	600	.0142	.0024	
415,107	2,100	.0368	....	
434,874	2,200	.0386	....	
454,641	2,300	.0405	....	
474,408	2,400	.0424	....	
494,175	2,500	.0444	.0035	
118,602	600	.0164	.0034	
....	600	.0164	.0035	Rested under initial load 16 hours. Micrometer reset.
513,942	2,600	.0482	....	
553,709	2,700	.0503	....	
553,476	2,800	.0524	....	
573,243	2,900	.0545	....	

No. 2067—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
593,010	3,000	.0570	.0066	
118,602	600	.0205	.0065	
....	600	.0205	.0065	
612,777	3,100	.0613	....	
632,544	3,200	.0640	....	
652,311	3,300	.0663	....	
672,078	3,400	.0692	....	
691,845	3,500	.0724	.0110	
118,602	600	.0259	.0108	
....	600	.0260	.0108	
711,612	3,600	.0800	....	
731,379	3,700	.0830	....	
751,146	3,800	.0870	....	
770,913	3,900	.0914	....	
790,680	4,000	.0974	.0205	
118,602	600	.0370	.0203	
....	600	.0370	.0203	
810,447	4,100	.1100	.0272	
....	600	.0453	.0272	
....	600	.0452	.0272	
810,447	4,100	....	....	Ultimate strength.

Column failed at the upper end. Opened oblique and longitudinal cracks 2″ to 31″ from the upper end of column.

Concrete columns made by James Black Masonry and Contracting Company, St. Louis, Mo.

No. 2068.

Column No. 1.

No reenforcement.

Gravel and rock concrete: 2 parts of gravel, 4 parts of rock by weight.

Mix 1–2–4.

Weight, 1,542 pounds.

Length over all, 96″.75.

Sectional area, 192.48 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,698	102	0.	0.	{Initial load. {Loaded with 14,000 pounds before testing.
29,547	153	.0002	0.	
39,396	204	.0006	0.	
49,245	255	.0012	0.	
59,094	307	.0015	.0001	
68,943	358	.0020	.0002	
78,792	409	.0025	.0002	
88,641	460	.0030	.0003	
98,490	511	.0035	.0003	
108,339	562	.0042	.0004	
118,188	614	.0049	.0005	
....	614	.0049	.0005	
128,037	665	.0055	....	
137,886	716	.0061	....	
147,735	767	.0068	....	
157,584	818	.0075	....	

No. 2068—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
167,433	870	.0082	....	
177,282	921	.0089	....	
187,131	972	.0096	....	
196,980	1,023	.0102	.0009	
118,188	614	.0055	.0009	
....	614	.0055	.0009	
216,678	1,125	.0116	....	
236,376	1,228	.0130	....	
256,074	1,330	.0145	....	
275,772	1,433	.0160	....	
295,470	1,535	.0177	.0017	
118,188	614	.0064	.0017	
....	614	.0064	.0017	
315,168	1,637	.0192	....	
334,866	1,740	.0208	....	
354,564	1,843	.0224	....	
374,262	1,944	.0240	....	
393,960	2,046	.0256	.0029	
118,188	614	.0077	.0027	
....	614	.0077	.0027	
413,658	2,150	.0272	....	
433,356	2,251	.0292	....	
453,054	2,354	.0310	....	
472,752	2,456	.0330	....	
492,450	2,558	.0348	.0048	
118,188	614	.0099	.0046	
....	614	.0099	.0046	
512,148	2,661	.0369	....	
531,846	2,763	.0392	....	
551,544	2,865	.0412	....	
571,242	2,968	.0434	....	
590,940	3,070	.0455	.0075	
118,188	614	.0127	.0070	
....	614	.0127	.0070	
610,638	3,172	.0480	....	
630,336	3,275	.0504	....	
650,034	3,377	.0526	....	
669,732	3,479	.0552	....	
689,430	3,582	.0582	.0115	
118,188	614	.0170	.0109	
....	614	.0169	.0109	
709,128	3,684	.0620	....	
728,826	3,786	.0660	....	
748,524	3,889	.0693	....	
768,222	3,991	.0725	....	
787,920	4,093	.0772	.0197	
118,188	614	.0258	.0190	
....	614	.0253	.0188	
....	614	.0245	.0182	After 5 minutes rest.
....	614	.0243	.0180	After 10 minutes rest.
807,618	4,196	.0880	.0255	
118,188	614	.0314	.0243	
....	614	.0314	.0242	Test discontinued.

Column not fractured.

No. 2069.

Column No. 2.

No reenforcement.

Gravel and rock concrete: 2 parts of gravel, 4 parts of rock by weight.

Mix 1-2-4.

Weight, 1,570 pounds.

Length over all, 96''.90.

Sectional area, 195.86 square inches.

Gauged length, 50''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,586	100	0.	0.	Initial load. Loaded with 14,000 pounds before testing.
29,379	150	.0001	0.	
39,172	200	.0003	0.	
48,965	250	.0005	0.	
58,758	300	.0008	.0002	
68,551	350	.0012	.0002	
78,344	400	.0017	.0002	
88,137	450	.0020	.0002	
97,930	500	.0025	.0002	
107,723	550	.0030	.0003	
117,516	600	.0035	.0004	
....	600	.0035	.0004	
127,309	650	.0040	....	
137,102	700	.0045	....	
146,895	750	.0050	....	
156,688	800	.0055	....	
166,481	850	.0060	....	
176,274	900	.0065	....	
186,067	950	.0070	....	
195,860	1,000	.0076	.0004	
117,516	600	.0034	.0004	
....	600	.0034	.0004	
215,446	1,100	.0088	....	
235,032	1,200	.0101	....	
254,618	1,300	.0114	....	
274,204	1,400	.0127	....	
293,790	1,500	.0140	.0010	
117,516	600	.0042	.0010	
....	600	.0042	.0010	
313,376	1,600	.0155	....	
332,962	1,700	.0175	....	
352,548	1,800	.0189	....	
372,134	1,900	.0200	....	
391,720	2,000	.0225	.0027	
117,516	600	.0052	.0025	
....	600	.0052	.0023	
411,306	2,100	.0236	....	
430,892	2,200	.0250	....	
450,478	2,300	.0263	....	
470,064	2,400	.0275	....	
489,650	2,500	.0293	.0029	
117,516	600	.0065	.0027	
....	600	.0064	.0027	Rested under initial load 16 hours. Micrometer reset.
509,236	2,600	.0310	....	
528,822	2,700	.0328	....	
548,408	2,800	.0347	....	
567,994	2,900	.0365	....	
587,580	3,000	.0380	.0052	
117,516	600	.0090	.0052	
....	600	.0090	.0052	
607,166	3,100	.0404	....	
626,752	3,200	.0418	....	
646,338	3,300	.0444	....	
665,924	3,400	.0460	....	
685,510	3,500	.0478	.0079	
117,516	600	.0119	.0075	
....	600	.0120	.0076	

No. 2069—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
705,096	3,600	.0483	....	
724,682	3,700	.0532	....	
744,268	3,800	.0537	....	
763,854	3,900	.0557	....	
783,440	4,000	.0600	.0120	
117,516	600	.0169	.0117	
....	600	.0165	.0115	
803,026	4,100	.0625	.0137	
117,516	600	.0185	.0134	
....	600	.0184	.0133	Test discontinued.

Column not fractured.

No. 2070.

Column No. 4.

No reenforcement.

Gravel and rock concrete: 2 parts of gravel, 4 parts of rock by weight.

Mix 1–2–4.

Weight, 1,570 pounds.

Length over all, 96″.40.

Sectional area, 191.64 square inches.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,164	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,746	150	.0010	0.	
38,328	200	.0020	.0001	
47,910	250	.0026	.0002	
57,492	300	.0032	.0001	
67,074	350	.0039	.0002	
76,656	400	.0045	.0004	
86,238	450	.0052	.0004	
95,820	500	.0059	.0005	
105,402	550	.0065	.0007	
114,984	600	.0072	.0007	
....	600	.0072	.0007	
124,566	650	.0079	....	
134,148	700	.0085	....	
143,730	750	.0092	....	
153,312	800	.0099	....	
162,894	850	.0105	....	
172,476	900	.0112	....	
182,058	950	.0118	....	
191,640	1,000	.0125	.0014	
114,984	600	.0078	.0014	
....	600	.0078	.0014	
210,804	1,100	.0139	....	
229,968	1,200	.0152	....	
249,132	1,300	.0165	....	
268,296	1,400	.0180	....	
287,460	1,500	.0195	.0021	
114,984	600	.0085	.0022	
....	600	.0085	.0022	

No. 2070—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
306,624	1,600	.0208	....	
325,788	1,700	.0222	....	
344,952	1,800	.0233	....	
364,116	1,900	.0250	....	
383,280	2,000	.0264	.0031	
114,984	600	.0095	.0030	
....	600	.0095	.0030	
402,444	2,100	.0278	....	
421,608	2,200	.0295	....	
440,772	2,300	.0310	....	
459,936	2,400	.0325	....	
479,100	2,500	.0342	.0045	
114,984	600	.0107	.0040	
....	600	.0107	.0041	Rested under initial load 16 hours. Micrometer reset.
498,264	2,600	.0359	....	
517,248	2,700	.0379	....	
536,592	2,800	.0396	....	
555,756	2,900	.0414	....	
574,920	3,000	.0433	.0069	
114,984	600	.0130	.0065	
....	600	.0130	.0065	
594,084	3,100	.0450	....	
613,248	3,200	.0473	....	
632,412	3,300	.0492	....	
651,576	3,400	.0512	....	
670,740	3,500	.0531	.0095	
114,984	600	.0158	0091	
....	600	.0158	.0091	
689,904	3,600	.0553	....	
709,068	3,700	.0578	....	
728,232	3,800	.0599	....	
747,396	3,900	.0620	....	
766,000	3,997	....	....	Ultimate strength.

Column ruptured explosively into a number of fragments about 2 feet from the upper end.

No. 2071.

Column No. 3.
No. reenforcement.
Gravel and rock concrete: 2 parts of gravel, 4 parts of rock by weight.
Mix 1–2–4.
Weight, 1,503 pounds.
Length over all, 96″.80.
Sectional area, 189.68 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,968	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,452	150	.0002	0.	
37,936	200	.0005	0.	
47,420	250	.0009	0.	
56,904	300	.0012	0.	
66,388	350	.0015	−.0003	
75,872	400	.0018	−.0003	
85,356	450	.0023	−.0003	
94,840	500	.0028	−.0003	
104,324	550	.0033	−.0002	
113,808	600	.0038	−.0001	
....	600	.0039	−.0001	
123,292	650	.0045	....	
132,776	700	.0051	0.	
142,260	750	.0057	....	
151,744	800	.0064	.0001	
161,228	850	.0070	....	
170,712	900	.0076	.0002	
180,196	950	.0082	....	
189,680	1,000	.0089	.0005	
113,808	600	.0045	.0005	
....	600	.0045	.0005	
208,648	1,100	.0100	....	
227,616	1,200	.0112	....	
246,584	1,300	.0124	....	
265,552	1,400	.0138	....	
284,520	1,500	.0150	.0007	
113,808	600	.0050	.0007	
....	600	.0050	.0007	
303,488	1,600	.0160	....	
322,456	1,700	.0174	....	
341,424	1,800	.0185	....	
360,392	1,900	.0200	....	
379,360	2,000	.0214	.0010	
113,808	600	.0050	.0007	
....	600	.0050	.0007	
398,328	2,100	.0220	....	
417,296	2,200	.0235	....	
436,264	2,300	.0250	....	
455,232	2,400	.0265	....	
474,200	2,500	.0280	.0012	
113,808	600	.0054	.0010	
....	600	.0054	.0010	
493,168	2,600	.0292	....	
512,136	2,700	.0312	....	
531,104	2,800	.0332	....	
550,072	2,900	.0352	....	
569,040	3,000	.0375	.0033	
113,808	600	.0078	.0030	
....	600	.0078	.0030	Rested under initial load 17 hours. Micrometer reset.
588,008	3,100	.0402	....	
606,976	3,200	.0435	....	Corner flaked off at upper end.
625,944	3,300	.0465	....	
644,912	3,400	.0497	....	
663,880	3,500	.0528	.0083	
113,808	600	.0136	.0080	
....	600	.0136	.0078	
698,000	3,680	....	....	Ultimate strength.

Column ruptured at the upper end into a number of fragments.

No. 2072.

Column No. 5.
Rock concrete.
Reenforcement: Four ¾″ longitudinal corrugated bars; ten ⅓″ corrugated bar hoops.
Weight, 1,542 pounds.
Length over all, 96″.80.
Sectional area, 189.26 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,926	100	0.	0.	Initial load. Loaded with 15,000 pounds before testing.
28,389	150	.0004	0.	
37,852	200	.0007	0.	
47,315	250	.0011	0.	
56,778	300	.0015	0.	
66,241	350	.0020	0.	
75,704	400	.0025	0.	
85,167	450	.0030	0.	
94,630	500	.0036	0.	
104,093	550	.0042	0.	
113,556	600	.0047	0.	
....	600	.0047	0.	
123,019	650	.0053	....	
132,482	700	.0059	.0001	
141,945	750	.0065	....	
151,408	800	.0072	.0002	
160,871	850	.0078	....	
170,334	900	.0085	.0002	
179,797	950	.0092	....	
189,260	1,000	.0099	.0003	
113,556	600	.0050	.0003	
....	600	.0050	.0003	
208,186	1,100	.0112	....	
227,112	1,200	.0125	....	
246,038	1,300	.0140	....	
264,964	1,400	.0155	....	
283,890	1,500	.0172	.0008	
113,556	600	.0055	.0007	
....	600	.0055	.0007	
302,816	1,600	.0188	....	
321,742	1,700	.0205	....	
340,668	1,800	.0220	....	
359,594	1,900	.0235	....	
378,520	2,000	.0252	.0020	
113,556	600	.0070	.0020	
....	600	.0070	.0020	
397,446	2,100	.0272	....	
416,372	2,200	.0290	....	
435,298	2,300	.0907	....	
454,224	2,400	.0328	....	
473,150	2,500	.0346	.0040	
113,550	600	.0090	.0037	
....	600	.0090	.0037	
492,076	2,600	.0370	....	
511,002	2,700	.0390	....	
929,928	2,800	.0415	....	
548,854	2,900	.0433	....	
567,780	3,000	.0455	.0062	
113,556	600	.0117	.0059	
....	600	.0115	.0059	Rested under initial load 64 hours.
18,926	100	.0048	....	
113,556	600	.0103	.0050	
....	600	.0104	.0050	
586,706	3,100	.0472	....	
605,632	3,200	.0500	....	
624,558	3,300	.0528	....	
643,484	3,400	.0554	....	
662,410	3,500	.0580	.0090	
113,556	600	.0147	.0085	
....	600	.0147	.0085	

No. 2072—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
681,336	3,600	.0620	....	
700,262	3,700	.0658	....	
719,188	3,800	.0710	.0155	
113,556	600	.0216	.0146	
....	600	.0215	.0146	
719,188	3,800	....	....	Ultimate strength.

Column ruptured about 3 feet from the upper end.

No. 2073.

Column No. 6.
Rock concrete.
Reenforcement: Four ¾″ longitudinal corrugated bars; ten ⅓″ corrugated bar hoops.
Weight, 1,534 pounds.
Length over all, 97″.10.
Sectional area, 188.57 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,857	100	0.	0.	{Initial load. {Loaded with 13,000 pounds before testing.
28,286	150	.0007	0.	
37,714	200	.0014	0.	
47,143	250	.0019	0.	
56,571	300	.0026	0.	
65,600	350	.0032	0.	
75,428	400	.0038	0.	
84,857	450	.0045	0.	
94,285	500	.0050	.0001	
103,714	550	.0056	.0002	
113,142	600	.0062	.0002	
....	600	.0064	.0002	
122,571	650	.0070	....	
131,999	700	.0074	.0003	
141,428	750	.0082	....	
150,856	800	.0090	.0005	
160,285	850	.0097	....	
169,713	900	.0104	.0005	
179,142	950	.0110	....	
188,570	1,000	.0118	.0006	
113,142	600	.0068	.0006	
....	600	.0067	.0006	
207,427	1,100	.0132	....	
226,284	1,200	.0147	....	
245,141	1,300	.0162	....	
263,998	1,400	.0177	....	
282,855	1,500	.0192	.0012	
113,142	600	.0074	.0012	
....	600	.0073	.0012	
301,712	1,600	.0206	....	
320,569	1,700	.0223	....	
339,426	1,800	.0238	....	
358,283	1,900	.0255	....	
377,140	2,000	.0273	.0024	
113,142	600	.0085	.0023	
....	600	.0085	.0023	

No. 2073—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
395,997	2,100	.0289	....	
414,854	2,200	.0307	....	
433,711	2,300	.0325	....	
452,568	2,400	.0344	....	
471,425	2,500	.0363	.0041	
113,142	600	.0102	.0038	
....	600	.0102	.0038	
18,857	100	.0025	....	Rested under initial load 17 hours.
113,142	600	.0089	.0026	
....	600	.0089	.0027	
490,282	2,600	.0377	....	
509,139	2,700	.0404	....	
527,996	2,800	.0427	....	
546,853	2,900	.0450	....	
565,710	3,000	.0472	.0064	
113,142	600	.0127	.0058	
....	600	.0127	.0058	
584,567	3,100	.0506	....	
603,424	3,200	.0533	....	
622,281	3,300	.0560	....	
641,138	3,400	.0590	....	
659,995	3,500	.0626	.0114	
113,142	600	.0184	.0105	
....	600	.0182	.0105	
678,852	3,600	.0700	.0168	
....	600	.0247	.0161	
....	600	.0245	.0160	
678,852	3,600	....	....	Ultimate strength.

Column ruptured 2 to 4 feet from the lower end.

No. 2074.

Column No. 7.
Rock concrete.
Reenforcement: Eight ½'' longitudinal corrugated bars; ten ¼'' corrugated bar hoops.
Weight, 1,546 pounds.
Length over all, 96''.80.
Sectional area, 190.66 square inches.
Gauged length, 50''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
19,066	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,599	150	.0002	0.	
38,132	200	.0005	0.	
47,665	250	.0008	0.	
57,198	300	.0013	0.	
66,731	350	.0017	0.	
76,264	400	.0023	0.	
85,797	450	.0027	0.	
95,330	500	.0033	0.	
104,863	550	.0038	0.	
114,396	600	.0043	0.	
....	600	.0043	0.	
123,929	650	.0048	....	
133,462	700	.0055	0.	

No. 2074—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
142,995	750	.0060	....	
152,528	800	.0068	.0002	
162,061	850	.0075	....	
171,594	900	.0081	.0004	
181,127	950	.0089	....	
190,660	1,000	.0095	.0004	
114,396	600	.0048	.0004	
....	600	.0048	.0004	
209,726	1,100	.0110	....	Rested under initial load 17 hours.
228,792	1,200	.0125	....	
247,858	1,300	.0140	....	
266,924	1,400	.0155	....	
285,990	1,500	.0173	.0012	
114,396	600	.0058	.0012	
....	600	.0058	.0012	
305,056	1,600	.0187	....	
324,122	1,700	.0204	....	
343,188	1,800	.0219	....	
362,254	1,900	.0235	....	
381,320	2,000	.0250	.0020	
114,396	600	.0068	.0018	
....	600	.0067	.0018	
400,386	2,100	.0265	....	
419,452	2,200	.0283	....	
438,518	2,300	.0300	....	
457,584	2,400	.0318	....	
476,650	2,500	.0336	.0032	
114,396	600	.0080	.0030	
....	600	.0080	.0030	
495,716	2,600	.0358	....	
514,782	2,700	.0378	....	
533,848	2,800	.0398	....	
552,914	2,900	.0418	....	
571,980	3,000	.0438	.0050	
114,396	600	.0102	.0047	
....	600	.0101	.0047	
591,046	3,100	.0458	....	
610,112	3,200	.0485	....	
629,178	3,300	.0509	....	
648,244	3,400	.0534	....	
667,310	3,500	.0558	.0080	
114,396	600	.0136	.0073	
....	600	.0134	.0073	
686,376	3,600	.0595	....	
705,442	3,700	.0629	....	
724,508	3,800	.0660	....	
743,574	3,900	.0698	....	
762,640	4,000	.0738	.0143	
114,396	600	.0211	.0136	
....	600	.0207	.0135	
781,706	4,100	.0800	.0170	
114,396	600	.0246	.0170	
....	600	.0246	.0168	
781,706	4,100	....	....	Ultimate strength.

Column fractured into a number of fragments at the upper end and opened longitudinal cracks 3 to 4 feet long.

No. 2075.

Column No. 10.

Gravel and rock concrete.

Reenforcement: Eight ½″ longitudinal corrugated bars; ten ¼″ medium steel hoops.

Weight, 1,546 pounds.

Length over all, 96″.80.

Sectional area, 189.68 square inches.

Gauged length, 50″.

Two cavities in column; first was 9″ from lower end, 2″ long, 2½″ wide, 2½″ deep; second was 3′ 3″ from lower end, 5″ long, 3″ wide, 5½″ deep.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,968	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,452	150	.0004	0.	
37,936	200	.0007	.0002	
47,420	250	.0011	.0002	
56,904	300	.0015	.0003	
66,388	350	.0020	.0005	
75,872	400	.0025	.0005	
85,356	450	.0030	.0005	
94,840	500	.0035	.0005	
104,324	550	.0041	.0005	
113,808	600	.0045	.0003	
....	600	.0044	.0002	
123,292	650	.0046	0.	
132,776	700	.0050	0.	
142,260	750	.0055	....	
151,744	800	.0062	.0002	
161,228	850	.0074	.0007	Rested under initial load 1 hour.
170,712	900	.0080	.0008	
180,196	950	.0086	....	
189,680	1,000	.0092	.0010	
113,808	600	.0050	.0010	
....	600	.0050	.0010	
208,648	1,100	.0102	....	
227,616	1,200	.0114	....	
246,584	1,300	.0126	....	
265,552	1,400	.0139	....	
284,520	1,500	.0150	.0010	
113,808	600	.0050	.0008	
....	600	.0048	.0008	
303,488	1,600	.0160	....	
322,456	1,700	.0174	....	
341,424	1,800	.0187	....	
360,392	1,900	.0200	....	
379,360	2,000	.0213	.0011	
113,808	600	.0052	.0011	
....	600	.0052	.0011	
398,328	2,100	.0228	....	
417,296	2,200	.0244	....	
436,264	2,300	.0258	....	
455,232	2,400	.0274	....	
474,200	2,500	.0289	.0024	
113,808	600	.0065	.0024	
....	600	.0066	.0024	
493,168	2,600	.0306	....	
512,136	2,700	.0323	....	
531,104	2,800	.0339	....	
550,072	2,900	.0356	....	
569,040	3,000	.0374	.0040	
113,808	600	.0085	.0039	
....	600	.0084	.0039	
588,008	3,100	.0386	....	
606,976	3,200	.0410	....	
625,944	3,300	.0429	....	

No. 2075—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
644,912	3,400	.0448	....	
663,880	3,500	.0469	.0056	
113,808	600	.0102	.0053	
....	600	.0102	.0053	
682,848	3,600	.0495	.0074	
113,808	600	.0124	.0070	
....	600	.0123	.0070	
701,816	3,700	.0545	....	
720,784	3,800	.0565	....	
739,752	3,900	.0590	....	
758,720	4,000	.0612	.0107	
113,808	600	.0156	.0098	
....	600	.0155	.0098	
772,000	4,070	....	....	Ultimate strength.

Column ruptured about middle of length, rupture starting at the upper cavity.

No. 2076.

Column No. 13.
Rock concrete.
Reenforcement: Eight ⅝″ longitudinal corrugated bars; twenty-four ¼″ corrugated hoops.
Weight, 1,540 pounds.
Length over all, 97″.05.
Sectional area, 189.12 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,912	100	0.	0.	Initial load. Loaded with 15,000 pounds before testing.
28,368	150	.0006	0.	
37,824	200	.0011	.0002	
47,280	250	.0017	.0002	
56,736	300	.0023	.0003	
66,192	350	.0030	.0004	
75,648	400	.0035	.0005	
85,104	450	.0042	.0005	
94,560	500	.0048	.0006	
104,016	550	.0055	.0007	
113,472	600	.0063	.0008	
....	600	.0063	.0008	
122,928	650	.0070	....	
132,384	700	.0077	.0009	
141,840	750	.0084	....	
151,296	800	.0092	.0010	
160,752	850	.0100	....	
170,208	900	.0107	.0012	
179,664	950	.0114	....	
189,120	1,000	.0122	.0014	
113,472	600	.0070	.0013	
....	600	.0070	.0013	
208,032	1,100	.0135	....	Rested under initial load 45 minutes.
226,944	1,200	.0150	....	
245,856	1,300	.0168	....	
264,768	1,400	.0184	....	
283,680	1,500	.0200	.0019	

No. 2076—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
113,472	600	.0076	.0018	
....	600	.0076	.0018	
302,592	1,600	.0217	....	
321,504	1,700	.0233	....	
340,416	1,800	.0250	....	
359,328	1,900	.0266	....	
378,240	2,000	.0283	.0030	
113,472	600	.0090	.0029	
....	600	.0090	.0029	
397,152	2,100	.0300	....	
416,064	2,200	.0320	....	
434,976	2,300	.0340	....	
453,888	2,400	.0360	....	
472,800	2,500	.0380	.0045	
113,472	600	.0109	.0044	
....	600	.0109	.0044	
491,712	2,600	.0401	....	
510,624	2,700	.0424	....	
529,536	2,800	.0444	....	
548,448	2,900	.0470	....	
567,360	3,000	.0490	.0069	
113,472	600	.0136	.0065	
....	600	.0135	.0065	
586,272	3,100	.0519	....	
605,184	3,200	.0545	....	
624,096	3,300	.0569	....	
643,008	3,400	.0594	....	
661,920	3,500	.0618	.0112	
113,472	600	.0180	.0100	
....	600	.0179	.0100	
680,832	3,600	.0678	....	
699,744	3,700	.0720	....	
718,656	3,800	.0780	.0220	
113,472	600	.0291	.0211	
....	600	.0290	.0210	
727,100	3,845	....	....	Ultimate strength.

Column failed by opening oblique and longitudinal cracks 30″ at the upper end and from 12″ to 30″ at lower end, the principal fracture being at the upper end.

No. 2077.

Column No. 8.
Rock concrete.
Reenforcement: Eight ½″ longitudinal corrugated bars. Ten ¼″ corrugated bar hoops.
Weight, 1,531 pounds.
Length over all, 96″.80.
Sectional area, 189.68 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,968	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,452	150	.0004	0.	
37,936	200	.0010	0.	
47,420	250	.0016	.0002	
56,904	300	.0024	.0003	
66,388	350	.0030	.0004	
75,872	400	.0037	.0005	
85,356	450	.0043	.0006	
94,840	500	.0050	.0006	
104,324	550	.0057	.0007	
113,808	600	.0064	.0007	
....	600	.0064	.0008	
123,292	650	.0071	....	
132,776	700	.0078	.0008	
142,260	750	.0085	....	
151,744	800	.0093	.0010	
161,228	850	.0100	....	
170,712	900	.0108	.0012	
180,196	950	.0115	....	
189,680	1,000	.0123	.0014	
113,808	600	.0071	.0014	
....	600	.0071	.0013	
18,968	100	.0010	....	After resting 16 hours.
113,808	600	.0067	.0010	
....	600	.0068	.0012	
208,648	1,100	.0136	....	
227,616	1,200	.0152	....	
246,584	1,300	.0168	....	
265,552	1,400	.0187	....	
284,520	1,500	.0202	.0023	
113,808	600	.0082	.0023	
....	600	.0082	.0023	
303,488	1,600	.0218	....	
322,456	1,700	.0234	....	
341,424	1,800	.0250	....	
360,392	1,900	.0266	....	
379,360	2,000	.0284	.0033	
113,808	600	.0093	.0033	
....	600	.0093	.0033	
398,328	2,100	.0302	....	
417,296	2,200	.0320	....	
436,264	2,300	.0338	....	
455,232	2,400	.0357	....	
474,200	2,500	.0375	.0052	
113,808	600	.0115	.0050	
....	600	.0114	.0050	
493,168	2,600	.0400	....	
512,136	2,700	.0420	....	
531,104	2,800	.0440	....	
550,072	2,900	.0463	....	
569,040	3,000	.0484	.0075	
113,808	600	.0140	.0072	
....	600	.0140	.0070	
588,008	3,100	.0510	....	
606,976	3,200	.0535	....	
625,944	3,300	.0560	....	
644,912	3,400	.0585	....	
663,880	3,500	.0612	.0113	

No. 2077—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
113,808	600	.0180	.0105	
....	600	.0179	.0105	
682,848	3,600	.0687	.0125	
113,808	600	.0197	.0122	
....	600	.0196	.0120	
701,816	3,700	.0695	....	
720,784	3,800	.0730	....	
739,752	3,900	.0777	....	
758,720	4,600	.0814	.0205	
113,808	600	.0278	.0197	
....	600	.0274	.0195	
758,720	4,000	....	....	Ultimate strength.

Column fractured into a number of fragments at the upper end, 18″ from the top.

No. 2078.

Column No. 9.
Gravel and rock concrete.
Reenforcement: Eight ½″ longitudinal corrugated bars; ten ¼″ medium steel hoops.
Weight, 1,526 pounds.
Length over all, 97″.20.
Sectional area, 186.53 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,653	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
27,980	150	.0002	0.	
37,306	200	.0004	0.	
46,633	250	.0007	0.	
55,959	300	.0011	0.	
65,286	350	.0016	0.	
74,612	400	.0020	0.	
83,939	450	.0025	0.	
93,265	500	.0030	0.	
102,592	550	.0035	0.	
111,918	600	.0040	0.	
....	600	.0040	0.	
121,245	650	.0045	....	
130,571	700	.0052	.0001	
139,898	750	.0058	....	
149,224	800	.0064	.0002	
158,551	850	.0070	....	
167,877	900	.0076	.0002	
177,204	950	.0082	....	
186,530	1,000	.0088	.0003	
111,918	600	.0045	.0003	
....	600	.0045	.0003	
205,183	1,100	.0100	....	
223,836	1,200	.0114	....	
242,489	1,300	.0127	....	
261,142	1,400	.0140	....	
279,795	1,500	.0154	.0008	
111,918	600	.0050	.0007	

No. 2078—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
....	600	.0050	.0007	
298,448	1,600	.0168	....	
317,101	1,700	.0184	....	
335,754	1,800	.0198	....	
354,407	1,900	.0212	....	
373,060	2,000	.0225	.0015	
111,918	600	.0058	.0015	
....	600	.0058	.0014	
391,713	2,100	.0240	....	
410,366	2,200	.0254	....	
429,019	2,300	.0270	....	
447,672	2,400	.0285	....	
466,325	2,500	.0300	.0025	
111,918	600	.0070	.0023	
....	600	.0070	.0023	
484,978	2,600	.0317	....	
503,631	2,700	.0335	....	
522,284	2,800	.0352	....	
540,937	2,900	.0368	....	
559,590	3,000	.0388	.0040	
111,918	600	.0086	.0036	
....	600	.0086	.0036	
18,653	100	.0030	....	After resting 45 minutes.
111,918	600	.0080	.0030	
....	600	.0080	.0031	
578,243	3,100	.0408	....	
596,896	3,200	.0430	....	
615,549	3,300	.0450	....	
634,202	3,400	.0472	....	
652,855	3,500	.0490	.0063	
111,918	600	.0113	.0058	
....	600	.0112	.0058	
671,508	3,600	.0507	....	
690,161	3,700	.0532	....	
708,814	3,800	.0556	....	
727,467	3,900	.0580	....	
746,120	4,000	.0602	.0095	
111,918	600	.0145	.0085	
....	600	.0145	.0085	
764,773	4,100	.0648	....	
783,426	4,200	.0675	....	
802,079	4,300	.0703	.0127	
111,918	600	.0185	.0120	
....	600	.0185	.0118	
811,000	4,348	....	....	Capacity of testing machine. Test discontinued.

Column not ruptured.

No. 2079.

Column No. 11.
Rock concrete.
Reenforcement: Eight ⅝″ longitudinal corrugated bars; nineteen ⅛ by ⅜″ medium steel hoops.
Weight, 1,491 pounds.
Length over all, 96″.75.
Sectional area, 183.35 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,335	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
27,503	150	.0002	0.	
36,670	200	.0005	0.	
45,838	250	.0008	0.	
55,005	300	.0013	.0001	
64,173	350	.0019	.0001	
73,340	400	.0024	.0002	
82,508	450	.0030	.0002	
91,675	500	.0035	.0003	
100,843	550	.0041	.0003	
110,010	600	.0046	.0005	
....	600	.0048	.0005	
119,178	650	.0054	....	
128,345	700	.0060	.0005	
137,513	750	.0065	....	
146,680	800	.0074	.0007	
155,848	850	.0080	....	
165,015	900	.0088	.0003	
174,183	950	.0095	....	
183,350	1,000	.0102	.0009	
110,010	600	.0052	.0009	
....	600	.0052	.0009	
201,685	1,100	.0116	....	
220,020	1,200	.0130	....	
238,355	1,300	.0147	....	
256,690	1,400	.0164	....	
275,025	1,500	.0180	.0016	
110,010	600	.0060	.0016	
....	600	.0060	.0016	
18,335	100	.0012	....	After resting 45 minutes.
110,010	600	.0056	.0013	
....	600	.0058	.0014	
293,360	1,600	.0192	....	
311,695	1,700	.0208	....	
330,030	1,800	.0223	....	
348,365	1,900	.0240	....	
366,700	2,000	.0258	.0017	
110,010	600	.0062	.0014	
....	600	.0060	.0012	
385,035	2,100	.0270	....	
403,370	2,200	.0290	....	
421,705	2,300	.0313	....	
440,040	2,400	.0332	....	
458,375	2,500	.0355	.0030	
110,010	600	.0080	.0029	
....	600	.0080	.0029	
476,710	2,600	.0386	....	
495,045	2,700	.0413	....	
513,380	2,800	.0440	....	Corner flaked off.
531,715	2,900	.0472	....	
550,050	3,000	.0498	.0070	
110,010	600	.0130	.0065	
....	600	.0130	.0065	
568,385	3,100	.0535	....	
586,720	3,200	.0563	....	

No. 2079—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
605,055	3,300	.0598	....	
623,390	3,400	.0630	....	
641,725	3,500	.0690	.0135	
110,010	600	.0208	.0125	
....	600	.0208	.0125	
734,100	4,004	....	....	Ultimate strength.

Column failed by opening oblique and longitudinal cracks at the lower end extending upward for about 30''.

No. 2080.

Column No. 12.
Rock concrete.
Reenforcement: Eight ⅝'' longitudinal corrugated bars; nineteen ⅛ by ⅜'' medium steel hoops.
Weight, 1,541 pounds.
Length over all, 96''.70.
Sectional area, 189.54 square inches.
Gauged length, 50''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,954	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,431	150	.0002	0.	
37,908	200	.0005	.0001	
47,385	250	.0010	.0002	
56,862	300	.0014	.0004	
66,339	350	.0019	.0005	
75,816	400	.0025	.0005	
85,293	450	.0030	.0006	
94,770	500	.0036	.0007	
104,247	550	.0042	.0008	
113,724	600	.0048	.0008	
....	600	.0048	.0008	
123,201	650	.0055	....	
132,678	700	.0060	.0010	
142,155	750	.0067	....	
151,632	800	.0074	.0010	
161,109	850	.0081	....	
170,586	900	.0089	.0012	
180,063	950	.0095	....	
189,540	1,000	.0102	.0014	
113,724	600	.0055	.0014	
....	600	.0055	.0014	
208,494	1,100	.0117	....	
227,448	1,200	.0132	....	
246,402	1,300	.0148	....	
265,356	1,400	.0162	....	
284,310	1,500	.0178	.0020	
113,724	600	.0062	.0019	
....	600	.0062	.0019	
303,264	1,600	.0190	....	
322,218	1,700	.0207	....	
341,172	1,800	.0223	....	
360,126	1,900	.0239	....	
379,080	2,000	.0255	.0028	
113,724	600	.0072	.0026	

No. 2080—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
....	600	.0072	.0026	
398,034	2,100	.0273	....	
416,988	2,200	.0291	....	
435,942	2,300	.0310	....	
454,896	2,400	.0328	....	
473,850	2,500	.0347	.0043	
113,724	600	.0090	.0040	
....	600	.0090	.0040	
492,804	2,600	.0365	....	
511,758	2,700	.0385	....	
530,712	2,800	.0405	....	
549,666	2,900	.0425	....	
568,620	3,000	.0450	.0060	
113,724	600	.0113	.0056	
....	600	.0113	.0056	
18,954	100	.0050	....	After resting 45 minutes.
113,724	600	.0105	.0052	
....	600	.0107	.0052	
587,574	3,100	.0477	....	
606,528	3,200	.0505	....	
625,482	3,300	.0527	....	
644,436	3,400	.0552	....	
663,390	3,500	.0580	.0095	
113,724	600	.0154	.0087	
....	600	.0154	.0087	
682,344	3,600	.0650	.0125	
113,724	600	.0196	.0117	
....	600	.0195	.0117	
682,344	3,600	....	....	Ultimate strength.

Column failed by opening oblique and longitudinal cracks at the upper end extending downward for about 36″.

No. 2081.

Column No. 14.
Rock concrete.
Reenforcement: eight ⅝″ longitudinal corrugated bars; ten ¼″ corrugated hoops.
Weight, 1,546 pounds.
Length over all, 96″.75.
Sectional area, 189.95 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
18,995	100	0.	0.	Initial load. Loaded with 16,000 pounds before testing.
28,493	150	.0004	0.	
37,990	200	.0007	0.	
47,488	250	.0012	0.	
56,985	300	.0015	.0002	
66,483	350	.0020	.0002	
75,980	400	.0025	.0003	
85,478	450	.0030	.0004	
94,975	500	.0037	.0004	
104,473	550	.0042	.0005	
113,970	600	.0049	.0005	
....	600	.0049	.0005	
123,468	650	.0055	....	
132,965	700	.0062	.0007	
142,463	750	.0068	....	
151,960	800	.0075	.0007	
161,458	850	.0082	....	
170,955	900	.0089	.0008	
180,453	950	.0097	....	
189,950	1,000	.0105	.0010	
113,970	600	.0055	.0010	
....	600	.0055	.0010	
208,945	1,100	.0120	....	
227,940	1,200	.0136	....	
246,935	1,300	.0152	....	
265,930	1,400	.0168	....	
284,925	1,500	.0186	.0018	
113,970	600	.0068	.0017	
....	600	.0067	.0017	
18,995	100	.0013	....	After resting 45 minutes.
113,970	600	.0063	.0013	
....	600	.0063	.0013	
303,920	1,600	.0200	....	
322,915	1,700	.0216	....	
341,910	1,800	.0234	....	
360,905	1,900	.0252	....	
379,900	2,000	.0270	.0025	
113,970	600	.0078	.0024	
....	600	.0078	.0024	
398,895	2,100	.0290	....	
417,890	2,200	.0310	....	
436,885	2,300	.0330	....	
455,880	2,400	.0350	....	
474,875	2,500	.0370	.0042	
113,970	600	.0098	.0038	
....	600	.0098	.0038	
493,870	2,600	.0392	....	
512,865	2,700	.0415	....	
531,860	2,800	.0440	....	
550,855	2,900	.0464	....	
569,850	3,000	.0490	.0063	
113.970	600	.0130	.0060	
....	600	.0130	.0060	
588,845	3,100	.0523	....	
607,840	3,200	.0557	....	
626,835	3,300	.0600	....	
645,830	3,400	.0680	.0202	
113,970	600	.0285	.0194	
....	600	.0287	.0194	
645,830	3,400	....	....	Ultimate strength.

Column failed by opening oblique and longitudinal cracks at the middle of length.

No. 1998.

1 : 2 : 3½ mixture.

Reenforced with triangular mesh wire cage; meshes 2½ by 4″. Inside dimensions of cage about 8¼ by 8¼″. Cage contains nine longitudinal wires ″.19 diameter each; mesh wires ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2; trap rock (⅛ to ½″), 3½.

Age, set in air, 10 months.

Weight of column, total, 753 pounds.

Weight of concrete, 738 pounds=139.6 pounds per cubic foot.

Weight of cage, 15 pounds.

Height of column, 96.12 inches.

Sectional area of column, 95.06 square inches. (9″.70 × 9″.80.)

Gauged length, 49″.5.

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
9,506	100	0.	0.	Loaded before testing with 9,500 pounds. Initial load.
14,259	150	.0007	0.	
19,012	200	.0016	0.	
23,765	250	.0025	0.	
28,518	300	.0035	.0002	
33,271	350	.0044	.0002	
38,024	400	.0056	.0003	
42,777	450	.0069	.0005	
47,530	500	.0081	.0007	
52,283	550	.0091	.0009	
57,036	600	.0105	.0011	
....	600	.0106	.0011	
61,789	650	.0177	....	
66,542	700	.0131	....	
71,295	750	.0146	....	
76,048	800	.0161	....	
80,801	850	.0178	....	
85,554	900	.0192	....	
90,307	950	.0208	....	
95,060	1,000	.0224	.0035	
....	600	.0139	.0036	
....	600	.0139	.0036	
104,566	1,100	.0261	....	
114,072	1,200	.0302	....	
123,578	1,300	.0346	....	
133,084	1,400	.0397	....	
142,590	1,500	.0471	.0122	
....	600	.0247	.0118	
....	600	.0245	.0117	
152,096	1,600	.0555	....	
161,602	1,700	.0649	....	
171,108	1,800	.0940	....	Ultimate strength.

Opened oblique and longitudinal cracks at distance of 2 and 3 feet from lower end of column.

No. 1999.

1 : 2 : 3½ mixture.

Reenforced with triangular mesh wire cage; meshes 2⅜ by 4″. Inside dimensions of cage about 8 by 8″. Cage contains 27 longitudinal wires ″.13 diameter each, in groups of three each, twisted together. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2; trap rock (⅛ to ½″), 3½.

Age, set in air, 10 months.

Weight of column, total, 762 pounds.

Weight of concrete, 744 pounds=141.8 pounds per cubic foot.

Weight of cage, 18 pounds.

Height of column, 96.13 inches.

Sectional area of column, 94.28 square inches. (9″.66 × 9″.76.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
9,428	100	0.	0.	Loaded with 9,000 pounds before testing. Initial load.
14,142	150	.0006	0.	
18,856	200	.0013	0.	
23,570	250	.0022	0.	
28,284	300	.0033	0.	
32,998	350	.0042	.0002	
37,712	400	.0055	.0003	
42,426	450	.0065	.0004	
47,140	500	.0075	.0005	
51,854	550	.0085	.0008	
56,568	600	.0096	.0012	
....	600	.0096	.0012	
61,282	650	.0105	....	
65,996	700	.0115	....	
70,710	750	.0127	....	
75,424	800	.0137	....	
80,138	850	.0148	....	
84,852	900	.0160	....	
89,566	950	.0173	....	
94,280	1,000	.0185	.0024	
....	600	.0111	.0024	
....	600	.0111	.0024	
103,708	1,100	.0208	....	
113,136	1,200	.0227	....	
122,564	1,300	.0249	....	
131,992	1,400	.0279	....	
141,420	1,500	.0308	.0049	
....	600	.0143	.0049	
....	600	.0144	.0048	
150,848	1,600	.0337	....	
160,276	1,700	.0374	....	
169,704	1,800	.0410	....	
179,132	1,900	.0451	....	
188,560	2,000	.0487	.0106	
....	600	.0213	.0106	
....	600	.0211	.0103	
197,988	2,100	.0550	....	
207,416	2,200	.0601	....	
216,844	2,300	.0678	....	
226,272	2,400	.0760	....	
233,000	2,471	....	....	Ultimate strength.

Opened oblique cracks near middle of height of column.

No. 2000.

1 : 2½ : 5 mixture.

Reenforced with triangular mesh wire cage; meshes, 5 by 4″. Inside dimensions of cage about 8 by 8″. Cage contains 27 longitudinal wires ″.13 diameter each, in groups of 3 each, twisted together. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2½; trap rock (⅛ to ½″), 5.

Age, set in air, ten months.

Weight of column, total, 741 pounds.

Weight of concrete, 726 pounds = 138.2 pounds per cubic foot.

Weight of cage, 15 pounds.

Height of column, 96.10 inches.

Sectional area of column, 94.48 square inches. (9″.67 × 9″.77.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
948	100	0.	0.	Loaded with 9,000 pounds before testing. Initial load.
14,172	150	.0012	0.	
18,896	200	.0025	.0002	
23,620	250	.0039	.0003	
28,344	300	.0050	.0008	
33,068	350	.0064	.0009	
37,792	400	.0077	.0011	
42,516	450	.0089	.0015	
47,240	500	.0105	.0016	
51,964	550	.0120	.0019	
56,688	600	.0138	.0023	
....	600	.0140	.0023	
61,412	650	.0155	....	
66,136	700	.0171	....	
70,860	750	.0186	....	
75,584	800	.0201	....	
80,308	850	.0215	....	
85,032	900	.0233	....	
89,756	950	.0250	....	
94,480	1,000	.0270	.0058	
....	600	.0185	.0058	
....	600	.0185	.0056	
103,928	1,100	.0325	....	
113,376	1,200	.0372	....	
122,824	1,300	.0453	....	
132,272	1,400	.0545	....	
141,720	1,500	.0740	....	Ultimate strength.

Opened oblique cracks 2½ to 4 feet from lower end of column.

No. 2001.

1 : 2½ : 5 mixture.

Reenforced with triangular mesh wire cage; meshes, 5 by 4″. Inside dimensions of cage about 8⅜ by 8⅜″. Cage contains nine longitudinal wires ″.19 diameter each. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2½; trap rock (⅛ to ½″), 5.

Age, set in air, ten months.

Weight of column, total, 747 pounds.

Weight of concrete, 736 pounds = 139.5 pounds per cubic foot.

Weight of cage, 11 pounds.

Height of column, 96.30 inches.

Sectional area of column, 94.67 square inches. (9″.69 × 9″.77.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
9,467	100	0.	0.	Loaded with 9,500 pounds before testing. Initial load.
14,201	150	.0006	0.	
18,934	200	.0017	0.	
23,668	250	.0027	0.	
28,401	300	.0036	0.	
33,135	350	.0046	0.	
37,868	400	.0058	0.	
42,602	450	.0072	0.	
47,335	500	.0085	0.	
52,069	550	.0098	0.	
56,802	600	.0108	.0001	
....	600	.0108	.0001	
61,536	650	.0127	....	
66,269	700	.0139	....	
71,003	750	.0154	.0007	
75,736	800	.0174	....	
80,470	850	.0192	....	
85,203	900	.0213	....	
89,937	950	.0233	....	
94,670	1,000	.0255	.0029	
....	600	.0157	.0028	
....	600	.0158	.0027	
104,137	1,100	.0322	....	
113,604	1,200	.0385	....	
123,071	1,300	.0479	....	
132,538	1,400	.0670	.0238	Ultimate strength.

Opened oblique and longitudinal cracks 2 to 3 feet from lower end of column.

No. 2002.

1 : 2 : 3½ mixture.

Reenforced with triangular mesh wire cage; meshes, 2½ by 4″. Inside diameter of cage about 10⅜″. Cage contains 27 longitudinal wires ″.13 diameter each, in groups of three each, twisted together. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2; trap rock (⅛ to ½″), 3½.

Age, set in air, ten months.

Weight of column, total, 907 pounds.

Weight of concrete, 889 pounds = 142.6 pounds per cubic foot.

Weight of cage, 18 pounds.

Height of column, 95.85 inches.

Sectional area of column, 112.34 square inches. (11″.96 diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,234	100	0.	0.	Loaded with 9,000 pounds before testing. Initial load.
16,851	150	.0006	0.	
22,468	200	.0013	0.	
28,085	250	.0021	0.	
33,702	300	.0029	.0001	
39,319	350	.0040	.0003	
44,936	400	.0051	.0008	
50,553	450	.0060	.0008	
56,170	500	.0070	.0009	
61,787	550	.0080	.0009	
67,404	600	.0091	.0012	
....	600	.0091	.0012	
73,021	650	.0104	....	
78,638	700	.0113	....	
84,255	750	.0123	....	
89,872	800	.0134	....	
95,489	850	.0147	....	
101,106	900	.0161	....	
106,723	950	.0173	....	
112,340	1,000	.0184	.0025	
....	600	.0108	.0027	
....	600	.0112	.0027	
123,574	1,100	.0206	....	
134,808	1,200	.0231	....	
146,042	1,300	.0255	....	
157,276	1,400	.0285	....	
168,510	1,500	.0320	.0059	
....	600	.0151	.0059	
....	600	.0153	.0059	
179,744	1,600	.0355	....	
190,978	1,700	.0387	....	
202,212	1,800	.0433	....	
213,446	1,900	.0465	....	
224,680	2,000	.0510	.0124	
....	600	.0225	.0123	
....	600	.0225	.0122	
235,914	2,100	.0593	....	
247,148	2,200	.0640	....	
258,382	2,300	.0702	....	
269,616	2,400	.0785	....	
280,850	2,500	.0960	.0345	
....	600	.0487	.0343	
....	600	.0482	.0340	
285,000	2,537	....	....	Ultimate strength.

Opened oblique cracks about 3 feet from lower end of the column.

No. 2003.

1 : 2 : 3½ mixture.

Reenforced with triangular mesh wire cage; meshes 2½ by 4″. Inside diameter of cage about 10½″. Cage contains nine longitudinal wires ″.19 diameter each, mesh wires ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2; trap rock (⅛ to ½″), 3½.

Age, set in air, 10 months.

Weight of column, total, 920 pounds.

Weight of concrete, 906 pounds = 146 pounds per cubic foot.

Weight of cage, 14 pounds.

Height of column, 95.10 inches.

Sectional area of column, 112.72 square inches. (11″.98 diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,272	100	0.	0.	{Loaded with 10,000 pounds before testing. Initial load.
16,908	150	.0007	0.	
22,544	200	.0014	0.	
28,180	250	.0023	0.	
33,816	300	.0031	0.	
39,452	350	.0038	.0002	
45,088	400	.0046	.0002	
50,724	450	.0055	.0005	
56,360	500	.0063	.0005	
61,996	550	.0073	.0006	
67,632	600	.0081	.0008	
....	600	.0081	.0009	
73,268	650	.0091	....	
78,904	700	.0098	....	
84,540	750	.0109	....	
90,176	800	.0119	....	
95,812	850	.0130	....	
101,448	900	.0140	....	
107,084	950	.0149	....	
112,320	1,000	.0159	.0018	
....	600	.0095	.0017	
....	600	.0096	.0018	
123,992	1,100	.0180	....	
135,264	1,200	.0200	....	
146,536	1,300	.0217	....	
157,808	1,400	.0237	....	
169,080	1,500	.0258	.0036	
....	600	.0114	.0036	
....	600	.0108	.0028	
180,352	1,600	.0280	....	
191,624	1,700	.0305	....	
202,896	1,800	.0330	....	
214,168	1,900	.0363	....	
225,440	2,000	.0397	.0071	
....	600	.0159	.0068	
....	600	.0155	.0070	
236,712	2,100	.0433	....	
247,984	2,200	.0461	....	
259,256	2,300	.0490	....	
270,528	2,400	.0545	....	
281,800	2,500	.0590	.0143	
....	600	.0236	.0140	
....	600	.0233	.0140	
293,072	2,600	.0658	....	
304,344	2,700	.0715	....	
315,616	2,800	.0825	.0264	
....	600	.0375	.0260	
....	600	.0371	.0257	
326,400	2,896	....	....	Ultimate strength.

Opened oblique and longitudinal cracks 1 foot from upper end of column.

No. 2004.

1 : 2 : 3½ mixture.

Reenforced with triangular mesh wire cage; meshes 5 by 4″. Inside diameter of cage about 10½″. Cage contains 27 longitudinal wires ″.13 diameter each, in groups of three each, twisted together. Mesh wires ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2; trap rock (⅛ to ½″), 3½.

Age, set in air, 10 months.

Weight of column, total, 917 pounds.

Weight of concrete, 902 pounds = 143.5 pounds per cubic foot.

Weight of cage, 15 pounds.

Height of column, 96 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Loaded with 10,000 pounds before testing. Initial load.
16,965	150	.0009	.0002	
22,620	200	.0017	.0002	
28,275	250	.0026	.0003	
33,930	300	.0035	.0004	
39,585	350	.0043	.0006	
45,240	400	.0053	.0007	
50,896	450	.0062	.0008	
56,550	500	.0071	.0010	
62,205	550	.0083	.0011	
67,860	600	.0092	.0013	
....	600	.0095	.0013	
73,515	650	.0106	....	
79,170	700	.0114	....	
84,825	750	.0125	....	
90,480	800	.0136	....	
96,135	850	.0148	....	
101,790	900	.0159	....	
107,445	950	.0173	....	
113,100	1,000	.0184	.0025	
....	600	.0111	.0025	
....	600	.0111	.0026	
124,410	1,100	.0205	....	
135,720	1,200	.0223	....	
147,030	1,300	.0247	....	
158,340	1,400	.0281	....	
169,650	1,500	.0302	.0055	
....	600	.0149	.0055	
....	600	.0149	.0054	
180,960	1,600	.0335	....	
192,270	1,700	.0377	....	
203,580	1,800	.0403	....	
214,890	1,900	.0435	....	
226,200	2,000	.0470	.0102	
....	600	.0202	.0100	
....	600	.0202	.0100	
237,510	2,100	.0523	....	
248,820	2,200	.0588	....	
260,130	2,300	.0629	....	
271,440	2,400	.0690	....	
282,750	2,500	.0762	.0227	
....	600	.0344	.0218	
....	600	.0338	.0219	
286,100	2,530	....	....	Ultimate strength.

Opened oblique and longitudinal cracks 2 feet from upper end of column.

No. 2005.

1: 2: 3½ mixture.

Reenforced with triangular mesh wire cage; meshes 5″ by 4″. Inside diameter of cage about 10½″. Cage contains nine longitudinal wires, ″.19 diameter each. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2; trap rock (⅛ to ½″), 3½.

Age, set in air, 9 months 19 days.

Weight of column, total, 910 pounds.

Weight of concrete, 899 pounds = 143.1 pounds per cubic foot.

Weight of cage, 11 pounds.

Height of column, 95.95 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Loaded with 10,000 pounds before testing. Initial load.
16,965	150	.0006	0.	
22,620	200	.0011	0.	
28,275	250	.0017	.0002	
33,930	300	.0024	.0002	
39,585	350	.0032	.0004	
45,240	400	.0041	.0005	
50,895	450	.0048	.0005	
56,550	500	.0058	.0006	
62,205	550	.0068	.0007	
67,860	600	.0077	.0009	
....	600	.0074	.0009	
73,515	650	.0085	....	
79,170	700	.0094	....	
84,825	750	.0105	....	
90,480	800	.0113	....	
96,135	850	.0126	....	
101,790	900	.0135	....	
107,445	950	.0148	....	
113,100	1,000	.0161	.0019	
....	600	.0091	.0020	
....	600	.0091	.0020	
124,410	1,100	.0181	....	
135,720	1,200	.0200	....	
147,030	1,300	.0218	....	
158,340	1,400	.0240	....	
169,650	1,500	.0270	.0042	
....	600	.0121	.0042	
180,960	1,600	.0296	....	
192,270	1,700	.0325	....	
203,580	1,800	.0355	....	
214,890	1,900	.0385	....	
226,200	2,000	.0425	.0082	
....	600	.0173	.0081	
....	600	.0172	.0081	
237,510	2,100	.0465	....	
248,820	2,200	.0500	....	
260,130	2,300	.0588	....	
271,440	2,400	.0615	....	
282,750	2,500	.0661	.0175	
....	600	.0275	.0175	
....	600	.0273	.0123	
294,060	2,600	.0781	....	
312,000	2,759	....	....	Ultimate strength.

Opened oblique and longitudinal cracks from 1 to 3 feet from upper end of column.

No. 2006.

1: 2½: 5 mixture.

Reenforced with triangular mesh wire cage; meshes 5 by 4". Inside diameter of cage about 10½". Cage contains 27 longitudinal wires, ".13 diameter each, in groups of three each, twisted together. Mesh wires, ".10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2½; trap rock (⅛ to ½"), 5.

Age, set in air, 9 months 19 days.

Weight of column, total, 893 pounds.

Weight of concrete, 879 pounds = 139.9 pounds per cubic foot.

Weight of cage, 14 pounds.

Height of column, 96.25 inches.

Sectional area of column, 112.72 square inches. (11".98 diameter.)

Gauged length, 50 inches.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,272	100	0.	0.	Loaded with 10,000 pounds before testing. Initial load.
16,908	150	.0009	0.	
22,544	200	.0019	0.	
28,180	250	.0029	.0001	
33,816	300	.0042	.0003	
39,452	350	.0055	.0007	
45,088	400	.0068	.0009	
50,724	450	.0081	.0010	
56,360	500	.0095	.0014	
61,996	550	.0113	.0017	
67,632	600	.0125	.0018	
....	600	.0131	.0020	
73,268	650	.0143	....	
78,904	700	.0164	....	
84,540	750	.0178	....	
90,176	800	.0192	....	
95,812	850	.0209	....	
101,448	900	.0229	....	
107,084	950	.0253	....	
112,720	1,000	.0269	.0060	
....	600	.0185	.0057	
....	600	.0183	.0057	
123,992	1,100	.0324	....	
135,264	1,200	.0379	....	
146,536	1,300	.0446	....	
157,808	1,400	.0541	....	
169,080	1,500	.0645	.0219	
....	600	.0384	.0220	
....	600	.0384	.0219	
177,000	1,570	.0990	....	Ultimate strength.

Opened oblique and longitudinal cracks near middle of height of column.

No. 2007.

1 : 2½ : 5 mixture.

Reenforced with triangular mesh wire cage; meshes 2½ by 4″. Inside diameter of cage about 10½″. Cage contains 27 longitudinal wires, ″.13 diameter each, in groups of three each, twisted together. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2½; trap rock (⅛ to ½″), 5.

Age, set in air, 9 months 18 days.

Weight of column, total, 898 pounds.

Weight of concrete, 880 pounds = 140 pounds per cubic foot.

Weight of cage, 18 pounds.

Height of column, 96 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Loaded with 16,000 pounds before testing. Initial load.
16,965	150	.0007	0.	
22,620	200	0015	0.	
28,275	250	.0026	0.	
33,930	300	.0036	.0001	
39,585	350	.0050	.0002	
45,240	400	.0060	.0004	
50,895	450	.0075	.0007	
56,550	500	.0090	.0010	
62,205	550	.0099	.0012	
67,860	600	.0115	.0014	
....	600	.0118	.0015	
73,515	650	.0130	....	
79,170	700	.0142	....	
84,825	750	.0161	....	
90,480	800	.0178	....	
96,135	850	.0193	....	
101,790	900	.0208	....	
107,445	950	.0225	....	
113,100	1,000	.0240	.0045	
....	600	.0160	.0046	
....	600	.0158	.0045	
124,410	1,100	.0295	....	
135,720	1,200	.0334	....	
147,030	1,300	.0388	....	
158,340	1,400	.0452	....	
169,650	1,500	.0552	.0177	
....	600	.0313	.0175	
....	600	.0310	.0172	
180,960	1,600	.0680	....	
192,270	1,700	.0850	.0355	
....	600	.0538	.0357	
....	600	.0534	.0356	
198,200	1,752	....	....	Ultimate strength.

Column failed 2½ feet from lower end, opening oblique and longitudinal cracks.

No. 2008.

1 : 2½ : 5 mixture.

Reenforced with triangular mesh wire cage; meshes 5 by 4″. Inside diameter of cage about 10½″. Cage contains nine longitudinal wires, ″.19 diameter each. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2½; trap rock (⅛ to ½″), 5.

Age, set in air, 9 months 17 days.

Weight of column, total, 904 pounds.

Weight of concrete, 894 pounds = 158 pounds per cubic foot.

Weight of cage, 10 pounds.

Height of column, 96.10 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	{Loaded with 10,000 pounds before testing. Initial load.
16,965	150	.0006	0.	
22,620	200	.0013	0.	
28,275	250	.0024	0.	
33,930	300	.0035	0.	
39,585	350	.0045	0.	
45,240	400	.0057	.0004	
50,895	450	.0069	.0004	
56,550	500	.0080	.0006	
62,205	550	.0091	.0008	
67,860	600	.0106	.0010	
....	600	.0109	.0014	
73,515	650	.0121	....	
79,170	700	.0131	....	
84,825	750	.0145	....	
90,480	800	.0160	....	
96,135	850	.0180	....	
101,790	900	.0192	....	
107,445	950	.0208	....	
113,100	1,000	.0221	.0039	
....	600	.0140	.0039	
....	600	.0140	.0038	
124,410	1,100	.0253	....	
135,720	1,200	.0306	....	
147,030	1,300	.0341	....	
158,340	1,400	.0389	....	
169,650	1,500	.0449	.0110	
....	600	.0228	.0110	
....	600	.0230	.0108	
180,960	1,600	.0520	....	
192,270	1,700	.0635	.0212	
....	600	.0350	.0211	
....	600	.0350	.0211	
203,580	1,800	.0795	.0300	
....	600	.0464	.0298	
....	600	.0464	.0297	
217,000	1,919	....	....	Ultimate strength.

Opened oblique and longitudinal cracks 3 feet from lower end of column.

No. 2009.

1 : 2½ : 5 mixture.

Reenforced with triangular mesh wire cage; meshes 2½ by 4″. Inside diameter of cage about 10½″. Cage contains nine longitudinal wires, ″.19 diameter each. Mesh wires, ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 2½; trap rock ⅛ to ½″), 5.

Age, set in air, 9 months 15 days.

Weight of column, total, 903 pounds.

Weight of concrete, 889 pounds = 143.6 pounds per cubic foot.

Weight of cage, 14 pounds.

Height of column, 96.05 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Loaded with 11,000 pounds before testing. Initial load.
16,965	150	.0010	0.	
22,620	200	.0020	0.	
28,275	250	.0031	.0001	
33,930	300	.0043	.0002	
39,585	350	.0057	.0004	
45,240	400	.0069	.0007	
50,895	450	.0081	.0009	
56,550	500	.0098	.0011	
62,205	550	.0112	.0013	
67,860	600	.0128	.0018	
....	600	.0133	.0021	
73,515	650	.0146	....	
79,170	700	.0163	....	
84,825	750	.0183	....	
90,480	800	.0200	....	
96,135	850	.0215	....	
101,790	900	.0230	....	
107,445	950	.0251	....	
113,100	1,000	.0275	.0062	
....	600	.0187	.0058	
....	600	.0187	.0058	
124,410	1,100	.0328	....	
135,720	1,200	.0388	....	
147,030	1,300	.0458	....	
158,340	1,400	.0545	....	
169,650	1,500	.0655	.0233	
....	600	.0398	.0234	
....	600	.0398	.0233	
180,960	1,600	.0955	.0438	
....	600	.0631	.0439	
....	600	.0628	.0439	
184,000	1,627	....	....	Ultimate strength.

Opened oblique and longitudinal cracks along middle of height of column.

No. 2010.

1:1½:3 mixture.

Reenforced with triangular mesh wire cage; meshes 5 by 4″. Inside diameter of cage about 10½″. Cage contains 27 longitudinal wires ″.13 diameter each, in groups of three each, twisted together. Mesh wires ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 1½; trap rock (⅛ to ½″), 3.

Age, set in air, 9 months 14 days.
Weight of column, total, 920 pounds.
Weight of concrete, 906 pounds = 145.2 pounds per cubic foot.
Weight of cage, 14 pounds.
Height of column, 96.10 inches.
Sectional area of column, 112.16 square inches. (11″.95 diameter.)
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,216	100	0.	0.	Initial load.
16,824	150	.0007	0.	
22,432	200	.0014	0.	
28,040	250	.0022	0.	
33,646	300	.0032	.0003	
39,256	350	.0040	.0004	
44,864	400	.0049	.0005	
50,472	450	.0058	.0005	
56,080	500	.0067	.0007	
61,688	550	.0074	.0009	
67,296	600	.0084	.0009	
....	600	.0084	.0010	
72,904	650	.0093	....	
78,512	700	.0100	....	
84,120	750	.0110	....	
89,728	800	.0119	....	
95,336	850	.0129	....	
100,944	900	.0137	....	
106,552	950	.0146	....	
112,160	1,000	.0155	.0019	
....	600	.0094	.0018	
....	600	.0095	.0018	
123,376	1,100	.0174	....	
134,592	1,200	.0195	....	
145,808	1,300	.0210	....	
157,024	1,400	.0226	....	
168,240	1,500	.0241	.0031	
....	600	.0109	.0030	
....	600	.0109	.0030	
179,456	1,600	.0261	....	
190,672	1,700	.0284	....	
201,888	1,800	.0306	....	
213,104	1,900	.0330	....	
224,320	2,000	.0351	.0054	
....	600	.0136	.0052	
....	600	.0134	.0050	
235,536	2,100	.0378	....	
246,752	2,200	.0398	....	
257,968	2,300	.0425	....	
269,184	2,400	.0455	....	
280,400	2,500	.0478	.0084	
....	600	.0163	.0078	
....	600	.0164	.0078	
291,616	2,600	.0515	....	
302,832	2,700	.0548	....	
314,048	2,800	.0576	....	
325,264	2,900	.0611	....	
336,480	3,000	.0641	.0136	
....	600	.0225	.0134	
....	600	.0225	.0132	
....	....	....	....	Rested under initial load 40 hours.
....	100	....	.0116	
....	600	.0208	.0116	
....	600	.0210	.0120	
347,696	3,100	.0710	....	
358,912	3,200	.0755	....	
370,128	3,300	.0819	....	
381,344	3,400	.0895	....	
386,000	3,442	....	....	Ultimate strength.

Opened oblique and longitudinal cracks in lower half of column.

No. 2011.

1:1½:3 mixture.

Reenforced with triangular mesh wire cage; meshes 5 by 4". Inside diameter of cage about 10½". Cage contains nine longitudinal wires ".19 diameter each. Mesh wires ".10 diameter.

Composition by volume: Vulcanite Portland cement, 1: sand (10-mesh sieve), 1½; trap rock (⅛ to ½"), 3.

Age, set in air, 9 months 15 days.

Weight of column, total, 929 pounds.

Weight of concrete, 919 pounds = 146.2 pounds per cubic foot.

Weight of cage, 10 pounds.

Height of column, 96 inches.

Sectional area of column, 113.10 square inches. (12" diameter.)

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Initial load.
16,965	150	.0005	0.	
22,620	200	.0011	0.	
28,275	250	.0020	0.	
33,930	300	.0025	0.	
39,585	350	.0034	.0002	
45,240	400	.0040	.0002	
50,895	450	.0047	.0002	
56,550	500	.0057	.0003	
62,205	550	.0065	.0005	
67,860	600	.0072	.0005	
....	600	.0073	.0005	
73,515	650	.0080	....	
79,170	700	.0087	....	
84,825	750	.0097	....	
90,480	800	.0105	....	
96,135	850	.0117	....	
101,790	900	.0123	....	
107,445	950	.0133	....	
113,100	1,000	.0140	.0011	
....	600	.0081	.0011	
....	600	.0081	.0008	
124,410	1,100	.0160	....	
135,720	1,200	.0181	....	
147,030	1,300	.0197	....	
158,340	1,400	.0215	....	
169,650	1,500	.0230	.0021	
....	600	.0097	.0021	
....	600	.0097	.0021	
180,960	1,600	.0247	....	
192,270	1,700	.0270	....	
203,580	1,800	.0286	....	
214,890	1,900	.0310	....	
226,200	2,000	.0338	.0042	
....	600	.0120	.0044	
....	600	.0121	.0045	
237,510	2,100	.0360	....	
248,820	2,200	.0385	....	
260,130	2,300	.0409	....	
271,440	2,400	.0440	....	
282,750	2,500	.0465	.0078	
....	600	.0159	.0078	
....	600	.0158	.0073	
294,060	2,600	.0496	....	
305,370	2,700	.0521	....	
316,680	2,800	.0554	....	
327,990	2,900	.0585	....	
339,300	3,000	.0625	.0133	
....	600	.0217	.0131	
....	600	.0214	.0128	

No. 2011—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
350,610	3,100	.0698	....	
361,920	3,200	.0743	....	
373,230	3,300	.0800	....	
384,540	3,400	.0855	.0231	
....	600	.0325	.0224	
....	600	.0321	.0223	
393,200	3,477	....	....	Ultimate strength.

Opened an oblique fracture in the upper half of the column.

No. 2012.

1 : 1½ : 3 mixture.

Reenforced with triangular mesh wire cage; meshes 2½ by 4″. Inside diameter of cage about 10½″. Cage contains 27 longitudinal wires ″.13 diameter each, in groups of three each, twisted together. Mesh wires ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 1½; trap rock (⅛ to ½″), 3.

Age, set in air, 9 months 12 days.

Weight of column, total, 925 pounds.

Weight of concrete, 907 pounds = 144 pounds per cubic foot.

Weight of cage, 18 pounds.

Height of column, 96.20 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauge length, 50″.

Applied loads.		In gauge length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Loaded with 11,000 pounds before testing. Initial load.
16,965	150	.0005	0.	
22,620	200	.0010	0.	
28,275	250	.0016	0.	
33,930	300	.0022	.0001	
39,585	350	.0031	.0003	
45,240	400	.0037	.0004	
50,895	450	.0045	.0005	
56,550	500	.0053	.0006	
62,205	550	.0062	.0007	
67,860	600	.0072	.0008	
....	600	.0072	0009	
73,515	650	.0080	....	
79,170	700	.0090	....	
84,825	750	.0096	....	
90,480	800	.0107	....	
96,135	850	.0116	....	
101,790	900	.0128	....	
107,448	950	.0135	....	
113,100	1,000	.0145	.0019	
....	600	.0083	.0019	
....	600	.0082	.0018	
124,410	1,100	.0165	....	
135,720	1,200	.0184	....	
147,030	1,300	.0204	....	
158,340	1,400	.0220	....	
169,650	1,500	.0240	.0036	
....	600	.0104	.0035	
....	600	.0105	.0036	
180,960	1,600	.0259	....	
192,270	1,700	.0280	....	
203,580	1,800	.0304	....	
214,890	1,900	.0328	....	
226,200	2,000	.0351	.0057	
....	600	.0132	.0056	
....	600	.0132	.0056	
237,510	2,100	.0384	....	
248,820	2,200	.0409	....	
260,130	2,300	.0435	....	
271,440	2,400	.0463	....	
282,750	2,500	.0490	.0104	
....	600	.0191	.0103	
....	600	.0190	.0100	
294,060	2,600	.0547	....	
305,370	2,700	.0584	....	
316,680	2,800	.0624	....	
327,990	2,900	.0689	....	
339,300	3,000	.0770	.0212	
....	600	.0304	.0208	
....	600	.0304	.0208	
349,000	3,086	....	....	Ultimate strength.

Opened long oblique crack in upper half of column.

No. 2013.

1 : 1½ : 3 mixture.

Reenforced with triangular mesh wire cage; meshes 2½ by 4″. Inside diameter of cage about 10½″. Cage contains nine longitudinal wires ″.19 diameter each. Mesh wires ″.10 diameter.

Composition by volume: Vulcanite Portland cement, 1; sand (10-mesh sieve), 1½; trap rock (⅛ to ½″), 3.

Age, set in air, 9 months 11 days.

Weight of column, total, 927 pounds.

Weight of concrete, 914 pounds = 145.3 pounds per cubic foot.

Weight of cage, 13 pounds.

Height of column, 96.20 inches.

Sectional area of column, 113.10 square inches. (12″ diameter.)

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,310	100	0.	0.	Loaded with 10,000 pounds before testing. Initial load.
16,965	150	.0007	0.	
22,620	200	.0014	0.	
28,275	250	.0023	.0002	
33,930	300	.0030	.0002	
39,585	350	.0040	.0003	
45,240	400	.0046	.0004	
50,895	450	.0055	.0007	
56,550	500	.0065	.0007	
62,205	550	.0073	.0009	
67,860	600	.0082	.0009	
....	600	.0081	.0010	
73,515	650	.0089	....	
79,170	700	.0098	....	
84,825	750	.0108	....	
90,480	800	.0116	....	
96,135	850	.0124	....	
101,790	900	.0135	....	
107,445	950	.0143	....	
113,100	1,000	.0154	.0018	
....	600	.0091	.0016	
....	600	.0092	.0016	
				Rested under initial load 16 hours.
124,410	1,100	.0175	....	
135,720	1,200	.0196	....	
147,030	1,300	.0211	....	
158,840	1,400	.0230	....	
169,650	1,500	.0250	.0034	
....	600	.0109	.0030	
....	600	.0110	.0032	
180,960	1,600	.0271	....	
192,270	1,700	.0297	....	
203,580	1,800	.0321	....	
214,890	1,900	.0342	....	
226,200	2,000	.0378	.0060	
....	600	.0140	.0060	
....	600	.0140	.0060	
237,510	2,100	.0411	....	
248,820	2,200	.0437	....	
260,130	2,300	.0462	....	
271,440	2,400	.0493	....	
282,750	2,500	.0523	.0111	
....	600	.0200	.0107	
....	600	.0200	.0107	
294,060	2,600	.0590	....	
305,370	2,700	.0629	....	
316,680	2,800	.0680	....	
327,990	2,900	.0732	....	
339,300	3,000	.0860	.0245	
....	600	.0351	.0236	
....	600	.0351	.0238	
339,600	3,003	....	....	Ultimate strength.

Opened oblique line of fracture across column at middle of height.

TABULATION OF TESTS OF PLAIN AND REENFORCED CONCRETE COLUMNS.

Height of columns, 8 feet, approximately.

No. of test.	Width and thickness, or diameter of column.	Composition.			Kind of stone.	Age.			Reenforcing metal.		Sectional areas.			Weight of concrete or mortar per cubic foot.	Compressive strength.	
		Cement.	Sand.	Stone.		Years.	Months.	Days.	Description.	Metal in longitudinal bars.	Gross.	Concrete or mortar.	Bars.		Total.	Per square inch on gross sectional area.
	Inches.									*Per ct.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
2058	13.00	1	3	3	⅛ to ½" trap rock	1	7	19	".39 wire helix, 1" pitch.		132.73			137.3	752,100	5,666
2059	13.00	1	3			1	7	20	do.		132.73			121.8	451,282	3,400
2061	13.00	1	3	3	⅛ to ½" trap rock	1	7	19	".24 wire helix, 1" pitch.		132.73			136.3	442,300	3,332
2062	13.00	1	3			1	7	21	do.		132.73			123.0	480,100	3,617
2063	16.02×16.00	1	2	3	Washed gravel	1	2	18	".40 wire helix, 1" pitch.		252.40				[a]807,680	3,200
2064	16.15×16.18	1	2	3	do.	1	2	19	do.		257.38				[a]810,747	3,150
2060	14.20×13.95	1	2	4	1½" and smaller trap rock.	2	2		Four 1½" dia. bars		198.09				608,500	3,072
2065	14.17×13.97	1	2	4	do.	2	2		do.		197.95				768,000	3,880
2066	14.19×13.94	1	2	4	do.	2	2		do.		197.81				675,000	3,412
2067	14.18×13.94	1	2	4	do.	2	2		do.		197.67				810,447	4,100
2068	14.04×14.03	1	2	4							192.48				[a]807,618	4,196
2069	14.11×14.20	1	2	4							195.86				[a]803,026	4,100
2070	14.06×13.95	1	2	4							191.64				766,000	3,997
2071	13.89×13.98	1	2	4							189.68				698,000	3,680
2072	13.89×13.95								Four ¾" corrugated bars.		189.26				719,188	3,800
2073	13.88×13.91								do.		188.57				678,852	3,600
2074	13.98×13.96								Eight ½" corrugated bars.		190.66				781,706	4,100
2075	14.00×13.87								do.		189.68				772,000	4,070
2076	13.97×13.86								Eight ⅝" corrugated bars.		189.12				727,100	3,845
2077	13.93×13.94								Eight ½" corrugated bars.		189.68				758,720	4,000
2078	13.84×14.13								do.		186.53				[a]811,000	4,348
2079	13.87×13.87								Eight ⅝" corrugated bars.		183.35				734,100	4,004
2080	13.93×13.93								do.		189.54				682,344	3,600

[a] Maximum load of testing machine applied. Column not fractured.

TABULATION OF TESTS OF PLAIN AND REENFORCED CONCRETE COLUMNS—Continued.

No. of test.	Width and thickness, or diameter of column.	Composition.			Kind of stone.	Age.			Reenforcing metal.		Sectional areas.			Weight of concrete or mortar per cubic foot.	Compressive strength.	
		Cement.	Sand.	Stone.		Years.	Months.	Days.	Description.	Metal in longitudinal bars.	Gross.	Concrete or mortar.	Bars.		Total.	Per square inch on gross sectional area.
	Inches.									*Per ct.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
2081	14.04×13.85								.....do		189.95				645,830	3,400
1998	9.70× 9.80	1	2	3½	⅛ to ½″ trap rock		10		Triangular mesh wire cage, meshes 2½ by 4″.		95.06			139.6	171,108	1,800
1999	9.66× 9.76	1	2	3½	.....do		10		Triangular mesh wire cage, meshes 2⅜ by 4″.		94.28			141.8	233,000	2,471
2000	9.67× 9.77	1	2½	5	.....do		10		Triangular mesh wire cage, meshes 5 by 4″.		94.48			138.2	141,720	1,500
2001	9.69× 9.77	1	2½	5	.....do		10		.....do		94.67			139.5	132,538	1,400
2002	11.96	1	2	3½	.....do		10		Triangular mesh wire cage, meshes 2½ by 4″.		112.34			142.6	285,000	2,537
2003	11.98	1	2	3½	.....do		10		.....do		112.72			146.0	326,400	2,896
2004	12.00	1	2	3½	.....do		10		Triangular mesh wire cage, meshes 5 by 4″.		113.10			143.5	286,100	2,530
2005	12.00	1	2	3½	.....do		9	19	.....do		113.10			143.1	312,000	2,759
2006	11.98	1	2½	5	.....do		9	19	.....do		112.72			139.9	177,000	1,570
2007	12.00	1	2½	5	.....do		9	18	Triangular mesh wire cage, meshes 2½ by 4″.		113.10			140.0	198,200	1,752
2008	12.00	1	2½	5	.....do		9	17	Triangular mesh wire cage, meshes 5 by 4″.		113.10			158.0	217,000	1,919
2009	12.00	1	2½	5	.....do		9	15	Triangular mesh wire cage, meshes 2½ by 4″.		113.10			143.6	184,000	1,627
2010	11.95	1	1½	3	.....do		9	14	Triangular mesh wire cage, meshes 5 by 4″.		112.16			145.2	386,000	3,442
2011	12.00	1	1½	3	.....do		9	15	.....do		113.10			146.2	393,200	3,477
2012	12.00	1	1½	3	.....do		9	12	Triangular mesh wire cage, meshes 2½ by 4″.		113.10			144.0	349,000	3,086
2013	12.00	1	1½	3	.....do		9	11	.....do		113.10			145.3	339,600	3,003

SHOT LINES.

TESTS OF LINEN SHOT LINES FOR THE UNITED STATES LIFE-SAVING SERVICE.

SHOT LINES.

No. 4 line.
Diameter, ″.15.
Lay, 1 turn in ″.60.
Number of strands, 3.
Number of threads in each, 8.
Length of sample, 15′.
Length between heads, 27″.

No. of coil.	Weight.		Ends of coil.	Tensile strength.	Parted.
	Pounds.	Ounces.		*Pounds.*	
101	10	4½	Outside	404	1 strand 13″ from head.
102	10	4	do	400	3 strands in head.
103	10	3	do	408	3 strands in center.
104	10	3½	do	388	1 strand 8″ from head.
105	10	4½	do	373	Do.
106	10	3½	do	398	1 strand 3″ from head.
107	10	4	do	408	2 strands 3″ from head.
108	10	5½	do	406	3 strands in head.
109	10	4	do	381	1 strand 3″ from head.
110	10	4½	do	408	3 strands 14″ from head.
111	10	5½	Inside	408	1 strand 12″ from head.
112	10	8½	Outside	408	2 strands 7″ from head.
113	10	5½	do	408	1 strand 12″ from head.
114	10	6½	do	408	1 strand at head.
a 115	10	4½	do	351	1 strand 3″ from head.
116	10	3	do	408	2 strands in middle.
a 117	10	3½	do	361	2 strands 12″ from head.
118	10	4½	do	383	3 strands at head.
119	10	4	Inside	439	3 strands 4″ from head.
120	10	2	Outside	398	1 strand 10″ from head.
121	10	5	do	408	1 strand 4″ from head. 1 strand at head.
122	10	4½	do	393	1 strand 7″ from head.
123	10	4	Inside	390	1 strand 8″ from head.
a 124	10	4	Outside	345	1 strand 4″ from head.
125	10	7½	do	447	1 strand 12″ from head.
126	10	4	do	396	1 strand 8″ from head.
127	10	4½	do	402	2 strands 12″ from head.
128	10	4½	do	379	2 strands 2″ from head.
129	10	3½	do	408	2 strands in middle.
130	10	5½	do	408	1 strand 9″ from head.
131	10	5½	Inside	408	1 strand in middle.
132	10	6½	Outside	408	1 strand 13″ from head.
133	10	3½	do	367	1 strand 3″ from head.
134	10	6	do	408	3 strands at head.
135	10	5½	do	386	2 strands 3″ from head.
136	10	6½	Inside	381	1 strand 11″ from head.
137	10	4	Outside	381	1 strand 3″ from head.
138	10	5½	do	408	1 strand 12″ from head.
139	10	6½	do	432	1 strand 4″ from head.
140	10	6½	do	408	1 strand in middle.
141	10	4½	do	408	Do.
142	10	3½	do	408	2 strands in middle.
143	10	5½	do	408	1 strand 11″ from head.
144	10	5½	do	408	1 strand 2″ from head.
145	10	4½	do	408	1 strand 6″ from head.
146	10	5½	do	408	1 strand 9″ from head.
147	10	4	do	408	3 stands in middle.
148	10	5	do	486	3 strands 7″ from head.
149	10	4	do	416	1 strand in head.
150	10	5	do	461	2 strands 8″ from head.

a RETEST.

115	10	4½	Outside	408	2 strands 2″ from head.
117	10	3½	do	408	1 strand 8″ from head.
124	10	4	do	449	1 strand 10″ from head.

SHOT LINES.

No. 7 line.
Diameter, ″.23.
Lay, 1 turn in 1″.27.
Number of strands, 3.
Number of threads in each, 18.
Length of sample, 15′.
Length between heads, 27″.

No. of coil.	Weight.	Ends of coil.	Tensile strength.	Parted
	Pounds.		*Pounds.*	
51	21¼	Outside	854	1 strand 12″ from the head.
a 52	21½	.....do	752	1 strand 13″ from the head.
53	21¾	.....do	830	1 strand 1″ from the head. 1 strand 16″ from the head.
a 54	21½	.....do	736	1 strand 13″ from the head.
55	21½	.....do	867	2 strands 14″ from the head.
56	21¼	.....do	911	1 strand 2″ from the head.
57	21¾	.....do	854	1 strand 11″ from the head.
58	21¼	.....do	887	2 strands in head.
59	21¼	.....do	918	2 strands 8″ from head.
60	21½	Inside	816	1 strand 9″ from head.
61	21¼	Outside	948	1 strand in head.
62	21	.....do	889	Do.
63	21¼	.....do	816	1 strand 5″ from head.
64	21½	.....do	870	1 strand 8″ from head.
65	21¼	.....do	918	1 strand 6″ from head.
66	21¼	.....do	816	1 strand 10″ from head.
67	21¼	.....do	893	2 strands 9″ from head.
68	21	.....do	888	1 strand 15″ from head.
69	21¼	.....do	845	1 strand 6″ from head.
70	21	.....do	865	1 strand 9″ from head.
71	20¾	.....do	918	1 strand in head.
72	21½	.....do	887	1 strand 2″ from head.
73	21¾	.....do	963	1 strand at head.
74	21¼	.....do	918	1 strand 8″ from head.
75	21¾	.....do	816	1 strand 11″ from head.
76	22	.....do	918	Do.
77	21¼	.....do	875	1 strand 3″ from head.
78	21	.....do	918	1 strand 7″ from head.
79	21¼	.....do	918	1 strand in middle.
80	21¼	.....do	963	1 strand 3″ from head.
81	22	.....do	1,003	1 strand 13″ from head.
82	21¼	.....do	987	1 strand 6″ from head.
83	21	.....do	910	1 strand 2″ from head.
84	21¼	.....do	918	1 strand in middle.
85	21¼	Inside	856	1 strand 4″ from head.
86	21	Outside	867	1 strand 9″ from head.
87	21¼	.....do	928	1 strand 12″ from head.
88	20½	.....do	816	1 strand 5″ from head.
89	21½	.....do	983	1 strand in middle.
90	21½	.....do	816	1 strand 12″ from head.
91	21½	.....do	851	1 strand 13″ from head.
92	21¼	.....do	918	1 strand in head.
93	21½	.....do	918	1 strand 9″ from head.
94	21¼	Inside	816	1 strand 14″ from head.
95	21	Outside	918	1 strand 8″ from head.
96	21¼	.....do	918	1 strand in middle.
97	21¼	.....do	918	1 strand in head.
98	21¼	.....do	912	Do.
99	21	.....do	816	Do.
100	21¼	Inside	864	1 strand 8″ from head.

a RETEST.

52	21½	Outside	918	1 strand 4″ from head.
54	21½	.....do	918	1 strand in head.

SHOT LINES.

No. 9 line.
Diameter, ″.32.
Lay, 1 turn in 1″.18.
Number of strands, 3.
Number of threads in each, 16.
Length of sample, 15′.
Length between heads, 27″.

No. of coil.	Weight.	Ends of coil.	Tensile strength.	Parted.
	Pounds.		*Pounds.*	
1	35	Outside	1,272	2 strands at head.
2	35	.....do	1,326	1 strand 13″ from head.
3	35	.....do	1,428	1 strand at head.
4	35	.....do	1,419	Do.
5	35	Inside	1,428	Do.
6	35	Outside	1,341	Do.
7	35	Inside	1,326	1 strand 4″ from head.
8	35	.....do	1,428	1 strand 1″ from head.
9	35½	Outside	1,387	1 strand at head.
10	34½	.....do	1,305	3 strands at head.
11	35	.....do	1,362	1 strand 12″ from head.
12	34¾	.....do	1,242	1 strand at head.
13	35½	.....do	1,264	1 strand 10″ from head.
14	35	.....do	1,232	1 strand 13″ from head.
15	35	Inside	1,224	1 strand 12″ from head.
[a]16	34¾	Outside	1,122	Do.
17	35¼	.....do	1,254	3 strands at head.
18	35½	.....do	1,448	1 strand 6″ from head.
19	34¾	.....do	1,224	1 strand 14″ from head.
20	35¼	.....do	1,335	1 strand 8″ from head.
21	35¼	Inside	1,224	1 strand 12″ from head.
22	34½	.....do	1,203	1 strand at head.
23	34¾	Outside	1,277	1 strand 4″ from head.
24	34¼	.....do	1,136	1 strand 6″ from head.
25	34¾	Inside	1,191	3 strands at head.
26	34½	Outside	1,203	1 strand at head.
27	34¼	.....do	1,224	Do.
28	34½	.....do	1,275	1 strand 12″ from head.
29	34¾	.....do	1,326	1 strand 9″ from head.
30	35	.....do	1,305	1 strand at head.
31	35¼	.....do	1,326	3 strands in head.
[a]32	34½	.....do	1,122	Do.
33	34¾	.....do	1,289	1 strand 12″ from head.
34	35¼	.....do	1,326	2 strands at head.
35	35½	.....do	1,297	1 strand 6″ from head.
36	34½	Inside	1,270	1 strand 5″ from head.
37	34½	Outside	1,224	3 strands in head.
38	34½	.....do	1,224	1 strand at head.
39	34½	.....do	1,226	1 strand 11″ from head.
40	34½	.....do	1,181	1 strand 8″ from head.
41	35	.....do	1,224	1 strand in head.
[a]42	34½	.....do	1,122	1 strand 10″ from head.
43	35½	.....do	1,428	1 strand 3″ from head.
44	35	.....do	1,256	3 strands in head.
45	35	.....do	1,176	1 strand in head.
46	35	.....do	1,152	Do.
47	34¾	.....do	1,173	1 strand 9″ from head.
[a]48	34¾	.....do	1,122	1 strand at head.
49	34¾	.....do	1,224	1 strand 13″ from head.
50	34¾	Inside	1,173	1 strand 4″ from head.

[a] RETEST.

16	34¾	Outside	1,264	3 strands in head.
32	34½	.....do	1,305	1 strand 8″ from head.
42	34½	.....do	1,224	1 strand 7″ from head.
48	34¾	.....do	1,244	1 strand 8″ from head.

BLUE PRINT AND BROWN PRINT PAPER.

PHOTOGRAPHIC BLUE AND BROWN PRINT PAPER.

Samples, 1″ wide, taken out lengthwise from paper. Length between jaws, 3″.

Description.	Color.	Thickness.	Sectional area.	First test.	Second test.	Third test.	Mean.	Tensile strength per square inch.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Dietzgen, No. 215, electric.	Blue....	.0049	.0049	25	32	33	30.00	6,120
Dietzgen, No. 215, electric rapid.	Blue....	.0046	.0046	31	32	32	31.67	6,880
Dietzgen, No. 229.........	Brown..	.0032	.0032	28	28	27	27.67	8,650
Dietzgen, No. 229½.........	Brown..	.0032	.0032	27	26	29	27.33	8,540
Dietzgen No. 237, electric.	Blue....	.0041	.0041	39	36	43	39.33	9,590
Dietzgen, No. 237, electric rapid...............	Blue....	.0044	.0044	33	34	40	35.67	8,110
Schmidt, No. 17, extra rapid..................	Blue....	.0041	.0041	23	23	23	23.00	5,610
Schmidt, No. 18, extra rapid..................	Blue....	.0053	.0053	27	28	27	27.33	5,160
Schmidt, No. 207, extra rapid..................	Blue....	.0044	.0044	34	33	29	32.00	7,270
Schmidt, No. 216, extra rapid..................	Blue....	.0059	.0059	39	41	36	38.67	6,560
New York Blueprint Paper Co., No. 110.........	Blue....	.0050	.0050	31	27	32	30.00	6,000
New York Blueprint Paper Co., No. 155.........	Brown..	.0030	.0030	27	29	27	27.67	9,220
Keuffel & Esser No. 229T..	Brown..	.0028	.0028	23	19	23	21.67	7,740
Keuffel & Esser, electric No. 1000...............	Blue....	.0044	.0044	29	30	30	29.67	6,740
Technical Supply Co., electric rapid No. 210........	Blue....	.0046	.0046	20	20	20	20.00	4,350
Technical Supply Co., electric rapid No. 217........	Blue....	.0040	.0040	41	45	44	43.33	10,830
Technical Supply Co., electric rapid No. 218.......	Brown..	.0028	.0028	30	20	29	26.33	9,400
Weil & Co., superior No. 131....................	Blue....	.0047	.0047	36	38	39	37.67	8,020
Weil & Co., superior No. 150....................	Brown..	.0030	.0030	17	16	16	16.33	5,440
Leet Bros.................	Brown..	.0027	.0027	20	13	16	16.33	6,050

PRIVATE TESTS.

Tests made for private parties during the fiscal year ended June 30, 1909:

Date.	Material.	Name.	City and State.
1908.			
July 1	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
10	.....do	.....do	Do.
11	Concrete	Waltham Gas Light Co	Waltham, Mass.
18	Wrought iron	B. M. Jones & Co	Boston, Mass.
20	Steel bar	Wheelock, Lovejoy & Co	Do.
23	Brick	New England Brick Co	Do.
23	Concrete building blocks.	Emerson & Norris Co	Do.
23	Scale lever	E. & T. Fairbanks Co	St. Johnsbury, Vt.
24	.....do	.....do	Do.
Aug. 10	Buoy shackles	The Fletcher & Crowell Co	Portland, Me.
11	.....do	.....do	Do.
11	Steel specimens	Savage Arms Co	Utica, N. Y.
12	Concrete building blocks.	M. E. Smith & Bro	Watertown, Mass.
12	.....do	Charles P. Barnwell	Buffalo, N. Y.
12	.....do	Concord Electric Co	Concord, N. H.
13	Granite cubes	Maguire & O'Heron	East Milton, Mass.
21	Concrete building blocks.	The Meriden Concrete Co	Meriden, Conn.
21	Cast iron	Somerville Iron Foundry	East Somerville, Mass.
25	Concrete pile	Benjamin Fox (Incorporated)	Boston, Mass.
25	Steel specimens	Savage Arms Co	Utica, N. Y.
26	Steel bar	Wheelock, Lovejoy & Co	Boston, Mass.
28	Buoy shackles	The Fletcher & Crowell Co	Portland, Me.
29	Manila rope	Columbian Rope Co	Auburn, N. Y.
Sept. 2	Concrete blocks	Boston Transit Commission	Boston, Mass.
2	Scale levers	E. & T. Fairbanks Co	St. Johnsbury, Vt.
8	Steel specimens	Savage Arms Co	Utica, N. Y.
8	.....do	Boston Elevated Railway Co	Boston, Mass.
11	.....do	Savage Arms Co	Utica, N. Y.
14	Bronze specimens	Victor Metals Co	East Braintree, Mass.
22	Steel column	Phoenix Iron Co	Phoenixville, Pa.
23	.....do	.....do	Do.
24	Steel specimens	Mesta Machine Co	Pittsburg, Pa.
24	Steel column	Phoenix Iron Co	Phoenixville, Pa.
25	.....do	.....do	Do.
25	Steel wire	Stanley Motor Carriage Co	Newton, Mass.
26	Steel column	Phoenix Iron Co	Phoenixville, Pa.
28	.....do	.....do	Do.
29	.....do	.....do	Do.
30	Nickel steel cylinder	.....do	Do.
Oct. 2	Scale levers	The Fairbanks Co	Boston, Mass.
2	Rubber belting	Revere Rubber Co	Do.
3	Wire rope	American Steel and Wire Co	Worcester, Mass.
5	Cast iron	The Davis & Farnum Manufacturing Co.	Waltham, Mass.
6	Manila rope	American Manufacturing Co	New York, N. Y.
7	.....do	.....do	Do.
8	.....do	.....do	Do.
8	.....do	Boston Elevated Railway Co	Boston, Mass.
8	Steel bar	Boston Transit Commission	Do.
8	Cement-filled column	Daniel Buckley	Dorchester, Mass.
26	Steel specimens	Savage Arms Co	Utica, N. Y.
29	Concrete building blocks.	Tandy Bedford Stone Co	Buffalo, N. Y.
29	Lally column	United States Column Co	Cambridge, Mass.
Nov. 2	Bronze specimens	American Manganese Bronze Co	New York, N. Y.
3	.....do	Victor Metals Co	East Braintree, Mass.
5	Steel specimens	Savage Arms Co	Utica, N. Y.
6	Cast iron	Golding Manufacturing Co	Franklin, Mass.
18	Bronze specimens	Victor Metals Co	East Braintree, Mass.
18	Steel specimens	J. W. Mitchell	Boston, Mass.
20	.....do	Savage Arms Co	Utica, N. Y.
24	Cement blocks	Boston Transit Commission	Boston, Mass.
28	Steel wire	J. W. Mitchell	Do.
30	Columns	G. J. Allen	Somerville, Mass.

Date.	Material.	Name.	City and State.
1908.			
Dec. 1	Steel specimens	General Electric Co	Schenectady, N. Y.
11	Bronze specimens	Victor Metals Co	East Braintree, Mass.
11	Aluminum specimens	Hood Rubber Co	East Watertown, Mass
24	Concrete-filled column	Louis Miller Co. (Incorporated)	Boston, Mass.
24	Wrought-iron specimens.	The Wyman & Gordon Co	Worcester, Mass.
29	Boiler plate steel	American Woolen Co	Maynard, Mass.
30	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
1909.			
Jan. 7	Buoy shackles	The Fletcher & Crowell Co	Portland, Me.
9	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
11	....do	....do	Do.
13	....do	....do	Do.
14	Steel bar	Golding Manufacturing Co	Franklin, Mass.
15	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
18	....do	Dr. P. H. Dudley	New York, N. Y.
23	Manila rope	Plymouth Cordage Co	North Plymouth, Mass.
23	Concrete block	W. J. Behn	Detroit, Mich.
25	Steel specimens	Dr. P. H. Dudley	New York, N. Y.
25	Concrete cubes	Department of engineering	Hartford, Conn.
26	Marble cubes	Crystal River Marble Co	Denver, Colo.
26	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
27	....do	....do	Do.
28	Concrete cubes	Department of engineering	Hartford, Conn.
30	....do	....do	Do.
Feb. 1	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
3	....do	....do	Do.
9	....do	Henry Disston & Sons	Philadelphia, Pa.
13	....do	The Wyman & Gordon Co	Worcester, Mass.
18	Concrete cubes	Department of engineering	Hartford, Conn.
19	....do	....do	Do.
19	Granite cubes	Dunn Mountain Granite Co	Salisbury, N. C.
23	Boiler plate	Hartford Steam Boiler Inspection and Insurance Co.	Boston, Mass.
24	Wrought-iron bolt	Montpelier and Wells River Railroad.	Montpelier, Vt.
27	Concrete cubes	Department of engineering	Hartford, Conn.
27	Buoy shackles	The Fletcher & Crowell Co	Portland, Me.
Mar. 1	....do	....do	Do.
2	Hoist hook	J. H. Williams & Co	Brooklyn, N. Y.
2	Concrete cubes	Department of engineering	Hartford, Conn.
5	Wire cables	American Steel and Wire Co	Worcester, Mass.
10	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
11	....do	....do	Do.
12	....do	....do	Do.
13	....do	....do	Do.
15	....do	....do	Do.
16	....do	....do	Do.
17	....do	....do	Do.
17	Brick masonry	George A. Fuller Co	Boston, Mass.
17	Bricks	Jenkins Brick Co	Montgomery, Ala.
19	Hollow building blocks	Denny-Renton Clay and Coal Co.	Seattle, Wash.
20	....do	....do	Do.
20	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
20	....do	Carpenter Steel Co	Reading, Pa.
22	Brick masonry	George A. Fuller Co	Boston, Mass.
26	Manila rope	American Manufacturing Co	New York, N. Y.
26	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
27	....do	....do	Do.
29	....do	....do	Do.
30	....do	....do	Do.
31	....do	....do	Do.
31	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
Apr. 1	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
2	....do	....do	Do.
3	....do	....do	Do.
5	....do	....do	Do.
6	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
6	Iron specimens	Laconia Car Company Works	Laconia, N. H.
7	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
8	....do	....do	Do.
9	Manila rope	Isthmian Canal Commission	Washington, D. C.
10	Concrete building blocks.	M. E. Smith & Bro	Watertown, Mass.

Date.	Material.	Name.	City and State.
1909 Apr. 12	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
13	do	do	Do.
14	do	dc	Do.
15	do	do	Do.
15	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
16	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
17	do	do	Do.
19	do	do	Do.
19	Steel bars	Simpson Bros. Corporation	Boston, Mass.
20	do	do	Do.
20	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
21	do	do	Do.
22	do	do	Do.
22	Cement bricks	Buffalo Paragon Wall Plaster Co.	Buffalo, N. Y.
23	Steel specimens	Gulick-Henderson & Co.	Pittsburg, Pa.
23	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
24	do	do	Do.
24	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
26	do	do	Do.
26	Columns	United States Column Co.	Cambridge, Mass.
27	do	do	Do.
27	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
28	do	do	Do.
29	do	do	Do.
30	do	do	Do.
30	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
May 1	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
3	Columns	The Market Forge Co.	Boston, Mass.
3	Cast iron	Waters Governor Co.	Everett, Mass.
4	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
5	do	do	Do.
5	Bricks	Fiske & Co. (Incorporated)	Boston, Mass.
6	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
7	do	do	Do.
8	do	do	Do.
8	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
10	Iron specimens	Laconia Car Company Works	Laconia, N. H.
10	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
11	do	do	Do.
11	Steel specimens	Pennsylvania Railroad Co.	Altoona, Pa.
12	do	do	Do.
13	do	J. W. Mitchell	Boston, Mass.
13	Concrete prisms and cubes.	J. R. Worcester & Co.	Do.
14	do	do	Do.
14	Concrete building blocks.	James Young	Brighton, Mass.
15	Cast-iron shelf supports.	The Snead & Co. Iron Works	Jersey City, N. J.
17	Rubber belting	Revere Rubber Co.	Chelsea, Mass.
17	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
18	do	do	Do.
19	do	do	Do.
19	Steel specimens	Planters Compress Co.	Boston, Mass.
20	do	The Wyman & Gordon Co.	Worcester, Mass.
20	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
21	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
21	Bricks	The M. W. Kellogg Co.	New York, N. Y.
24	Steel specimens	The Wyman & Gordon Co.	Worcester, Mass.
24	Steel cylinders	J. W. Mitchell	Boston, Mass.

Date.	Material.	Name.	City and State.
1909. May 25	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
26	....do	....do	Do.
27	....do	....do	Do.
27	Springs	A. & J. M. Anderson Manufacturing Co.	South Boston, Mass.
28	....do	....do	Do.
28	Rail joints	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
29	Bricks	Walter Atherton	Boston, Mass.
29	Columns	United States Column Co	Cambridge, Mass.
June 1	Steel latch	Planters Compress Co	Boston, Mass.
2	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
2	Manila rope	Isthmian Canal Commission	Washington, D. C.
3	Bronze	General Electric Co	Schenectady, N. Y.
7	Brass	Isthmian Canal Commission	Washington, D. C.
7	Steel specimens	J. W. Mitchell	Boston, Mass.
8	Building block	M. E. Smith & Bro	Watertown, Mass.
9	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
11	Steel latch	Planters Compress Co	Boston, Mass.
14	Rails	American Railway Engineering and Maintenance of Way Association.	Chicago, Ill.
15	....do	....do	Do.
16	....do	....do	Do.
16	Brass specimens	Hartford Laboratory Co	Hartford, Conn.
18	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
18	Cast iron	Pickering Governor Co	Portland, Conn.
19	Steel specimens	The Wyman & Gordon Co	Worcester, Mass.
21	....do	....do	Do.
21	Concrete cubes	Department of engineering	Hartford, Conn.
22	Combination piles	Monks-Ripley Pile Co	New York, N. Y.
22	Aluminum	Lightning Hose Coupling Co	Boston, Mass.
23	....do	....do	Do.
23	Combination piles	Monks-Ripley Pile Co	New York, N. Y.
25	Shackles	The Fletcher & Crowell Co	Portland, Me.
26	....do	....do	Do.
28	....do	....do	Do.
29	Wrought-iron bars	Bradlee & Co	Philadelphia, Pa.
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